OBSERVATIONS

The Journal of the Harvard Forest Schoolyard Ecology Program

Volume 1

June 2026

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Lowell Environmental Youth Task Force students measure the diameter of a tree at Harvard Forest

About, Welcome, and Thank You for Reading!

Welcome to the first volume of the Harvard Forest Journal of Schoolyard Ecology. Thank you so much for reading! We are excited to share Schoolyard Profiles, which describe a few of the places where Schoolyard Ecology research is taking place, and data visualizations, which are student-run analysis of the ecological changes they're seeing in their schoolyards. We want to extend a special thanks to our peer reviewers, teachers, schoolyard ecologists, and funders who made this journal possible!

Jen Nilsen, Graduate Research Assistant at the Harvard Forest

Message from Schoolyard Ecology

Since 2004, the Schoolyard Ecology program at Harvard Forest has supported K12 educators in building their students' ecological data skills and literacy through year-round professional development and coaching support.

Through our participatory science projects, we empower students and the adults who support them to use science as a tool for building a relationship with the natural world, and ultimately to join the community of climate change problem solvers.

We are thrilled to present this first volume and provide the students in our program an opportunity to share with each other the questions that they have been asking and what they have been seeing in their schoolyards.

Katharine S. Hinkle, Youth Education Manager

Message from Harvard Forest

Since our founding in 1907, Harvard Forest has been dedicated to training and inspiring the next generation of ecologists. For the Forest's first century, our students came only from universities. Since 2004, we've been fortunate to expand our work to connect with younger scientists and their teachers. Research on how people learn has shown over and over that professional scientists begin their journey as young people. We are fortunate to be able to publish, in this journal, the first studies of the next generation of scientists, and to continue to support their journey. One day we will be able to say, "we knew them when!"

Clarisse Hart, Director of Outreach & Education

Acknowledgements

We are deeply grateful to our Schoolyard Ecology supporters and contributors who have made the publication of this journal possible. An important part of the scientific writing process is peer review. This year all data visualizations and stories received both peer reviews and feedback from adult reviewers.

Student Peer Review Panel

This year's peer review panel came from students at Woodstock Academy in Woodstock, CT under the guidance of their teacher Melany Gronski. We thank them for their invaluable contributions to this important part of the scientific process: Finnley Salzarulo-Syphers, Greysen Dery, Grette Zheng, Mike Gia, Bao Vu, Bella Stillatano, Jialiang Fu.

Student peer review panel hard at work

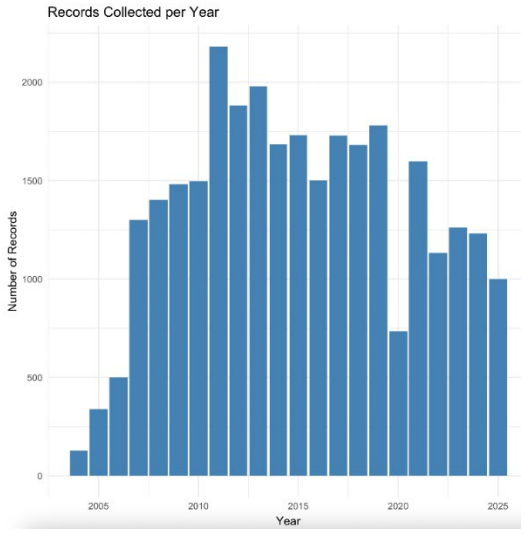
Adult Review Panel

This year's adult review panel came from the Climate Leaders Program at Harvard University, an interdisciplinary group of students from graduate schools across campus. Thank you to Owen Gow, Maxine Scherz, Anna Mortara, and Sitara Sitay.

Cover photo contributed by Haylie, Tessa, and Tyler from the JR Briggs Elementary School in Ashburnham, MA.

Unless otherwise noted, data visualization stories come from the 7th grade class of Jane Lucia at Williston Northampton School in Easthampton, MA

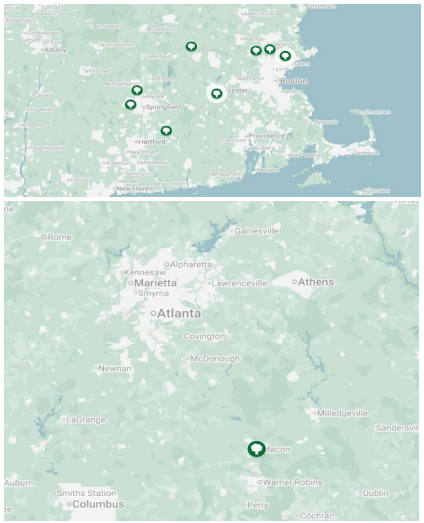
Schoolyard by the Numbers



This graph shows all the fall and spring phenology observations that students have made for the Buds, Leaves & Global Warming research project since 2004, when the Harvard Forest Schoolyard Ecology project began. Today, there are over 30,000 observations across all Schoolyard Ecology research projects. Note-data from the 2025-2026 is still being sent in by participating educators.

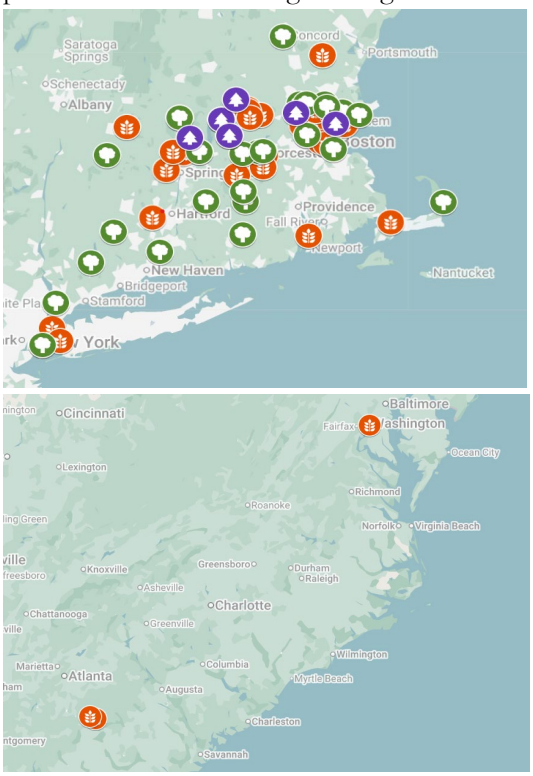
Our Contributors

This year, our contributors came from 9 different school-yard sites in two different states. Both school sites and a Mass Audubon sanctuary contributed. From our school sites we have representatives from 5th grade-12th grade.



Our Participants

Schoolyard Ecology at Harvard Forest is proud to partner with our many contributing sites from classrooms to nature centers to homeschool collaboratives. There are currently 68 participating schools and nature centers in 7 different states. 34% of our current sites have been contributing data for 5 or more years. Our participating students range in age from preschool students through 12th grade.



Buds, Leaves, and Global Warming Site

Our Changing Forest Site

Hemlock Wooly Bully Site

Data Explainer

In many of data stories you will read, you see reference to "Julian Day." This refers to the continuous count of days starting with January 1st as Julian Day 1. Therefore, Julian Day 190 is July 9th. Additionally, when you see "Tree Color" or "Leaf Color" in a graph, this 4 point system corresponds to percentage change from green, with 1 being 0-25% changed, 2 being 26-50% changed, 3 being 51-75% changed and 4 being 76-100% change

Schoolyard Profile: Essex North Shore Agricultural and Technical School – Danvers, MA

Established in 2024 and managed by Laura Gallant

Essex Tech is participating in both the Buds, Leaves, and Global Warming (BLGW) study and the Our Changing Forests (OCF) study. We are monitoring three trees for the BLGW project and have two sites established for the OCF project. Our landscape is a working farm in a suburban area.

BLGW tree locations: along a roadway in open field habitat. We are monitoring three branches on each tree. We are monitoring a Red Maple, Pin Oak, and American Basswood.

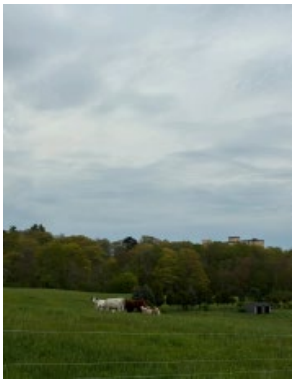
Red Maple Tree

Pin Oak Tree

American Basswood Tree

Our Changing Forests Locations:

Our plots for the OCF study are in two distinct areas. An upland White Pine and Red Oak forest with edge habitat surround by farm fields and a lowland American Beech grove habitat located on the edge of a pond and forest path.



Pine stand and farm field from a distance

Beech Grove

Essex North Shore Agricultural and Technical School Students' Research Questions:

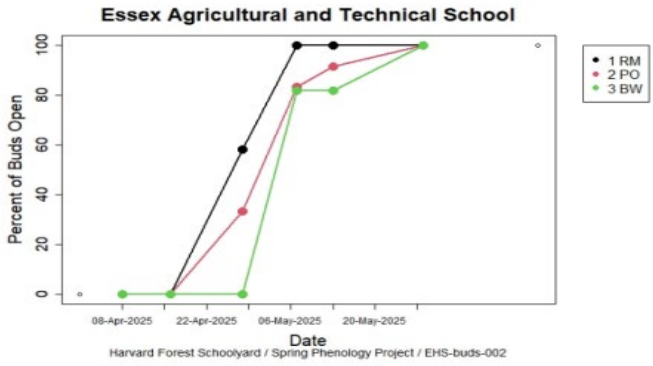
Introduction

Essex North Shore Agricultural and Technical School Students observed leaf fall and bud burst for School Year 2024-2025 and are observing them again during this school year, 2025-2026. We observed three native tree species growing along Maple St. (State Route 62) in Danvers, MA. The trees are a Red Maple, a Pin Oak, and an American Basswood. The Red Maple and Pin Oak are similar in age. The Basswood is a much older tree on the "old Aggie" campus. Students analyzed their observations below using the data visualization tool on the Harvard Forest Database.

Spring 2025 Data

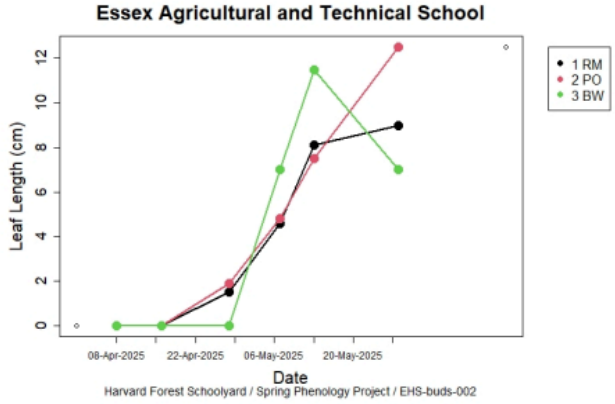
Which species had buds burst the quickest?

Below, there is a graph demonstrating data collected in the spring of 2025 regarding how quickly the buds of three tree species opened, measured by the percentage of buds on the tree that were burst at the Essex North Shore Agricultural and Technical School campus. The three tree species surveyed were Red Maple (RM), Pin Oak (PO), and Basswood (BW). The data shows that the Red Maple has its buds burst the quickest. While it's notable that the Pin Oak was observed to have started this process on the same day, the Red Maple had more buds burst and was the first species to have all of its buds burst, hence why it is regarded as the fastest.



Which species' leaves grew the fastest?

In the spring of 2025, students of Essex North Shore Agricultural and Technical School recorded the growth of leaves over time. On the next page is a graph showing three tree species: Pin Oak (PO), Basswood (BW), and Red Maple (RM). The data shows that the basswood leaves grew the fastest. It is important to note that there is some inconsistency in the data, as the basswood trendline appears to trend downward as if it were shrinking, while the others were growing. This means that someone must have misrecorded information.

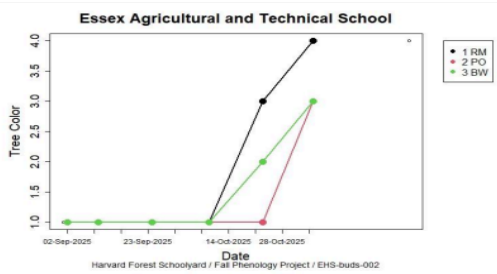


Which species had the largest leaves by the end of the survey?

The graph above shows the length of leaves (in centimeters) belonging to the same three tree species at the Essex North Shore Agricultural and Technical School campus mentioned in previous analyses, also during the spring of 2025. Interestingly enough, while it may not be the fastest grower, Pin Oaks reached the largest length by the end of the survey. The data points on the graph clearly show how the pin oak leaf was over 12 centimeters, while leaves on the other trees didn't reach that value.

Fall 2025 Data

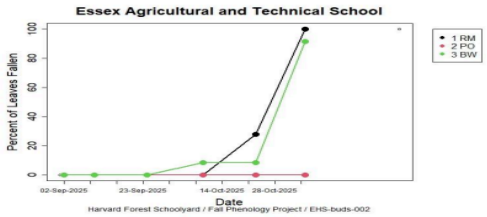
Which species turned color on the whole tree first?



The species that turned color on the whole tree first was Red Maple (Black Line). The X-axis represents the date the tree started turning color. Although the Pin Oak (Red Line) has almost the same line on the graph,

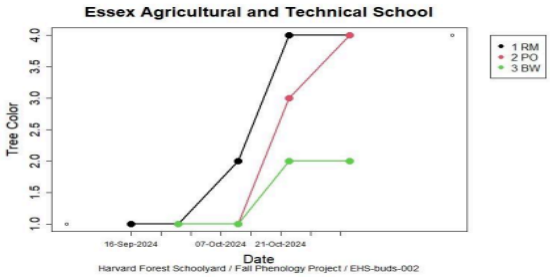
the Red Maple gets to the highest point on the Y-axis (4.0) first.

Which species lost all its leaves first?



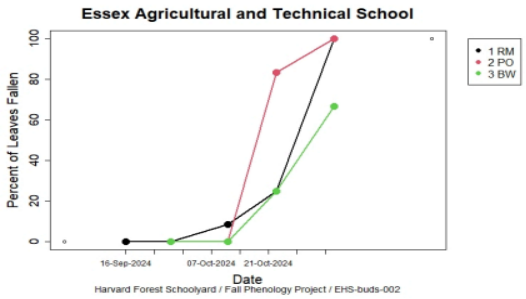
At Essex Agricultural and Technical School. Students collect data from different kinds of trees. The collected fall phenology data from 2025 included 3 different species: Red Maple (RM), Basswood (BW), and Pin Oak (PO). The graph shows that Red Maple was the first species to lose all its leaves. Red Maple in the graph is represented by a black line.

<u>Fall 2024 Data:</u> Which species turned color on the whole tree first?



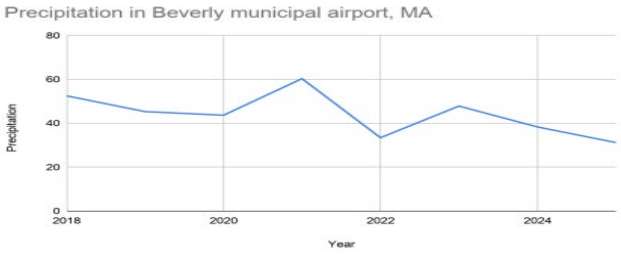
This graph shows the progression of leaf color on the observed trees in the Fall of 2024. The trees that were observed had their data collected in 5 different dates from September through October. These trees included a Red Maple (RM), Pin Oak (PO), and a Basswood (BW). According to the graph, it can be determined that the first tree to have its leaves entirely change in color, was the Red Maple, which was also the first tree to have its leaves partially change color.

Which species lost all its leaves first?

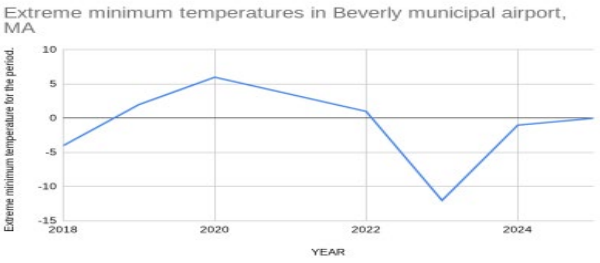


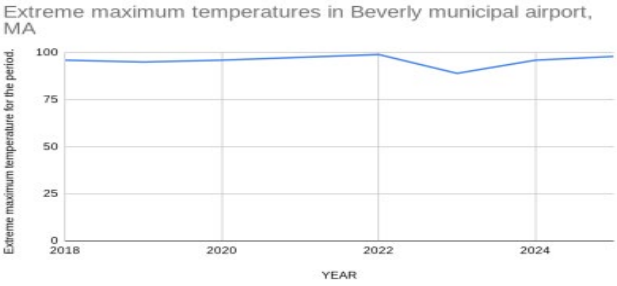
This graph shows the progression of leaves fallen for the fall of 2024 from September through October. We recorded data 5 different times from three different trees: red maple (RM), Pin oak (PO), and American basswood (BW). According to the graph, it's seen that the first tree to lose all its leaves was the Red Maple. Though it did not take long for the Pin Oak and Basswood to lose all their leaves

<u>Weather Data for Location</u>



The data in this graph is from 2018 to 2025. The precipitation in 2024 was 38.35 inches. The precipitation in 2025 was 31.23 inches. From 2024 to 2025, the precipitation decreased by 7.12 inches.





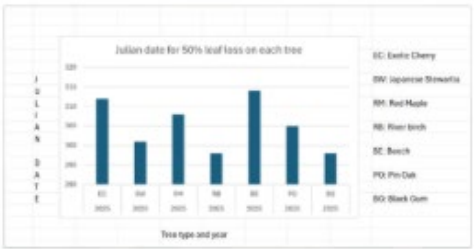
Between 2024 and 2025 the decrease in precipitation was 7.12 inches which can affect how the leaves fall on trees and the overall color change of the leaves themselves. Without water, plants' production of glucose from photosynthesis ceases which causes leaves to dry out and turn brown, eventually falling off. The decrease in precipitation between 2024 and 2025 would most likely have affected many leaves resulting in overall more leaves falling and trees not being able to change color.

Conclusion

Essex Tech students will continue to collect data. This data will be more meaningful and show more interesting trends as we have more years to reflect upon. Possible confounding factors in our data so far include Arboriculture students trimming branches. This caused us not to be able to observe the same branches continuously. We also had some insect damage, which caused the data error in spring 2025 where Basswood leaves got smaller instead of larger as the season progressed. Our main difficulty is finding branches we can reach and observe closely that are not going to get trimmed by grounds crew or Arboriculture and Landscape students.

Gus and Bayar's Research Question: How does the species of tree affect when the leaves drop?

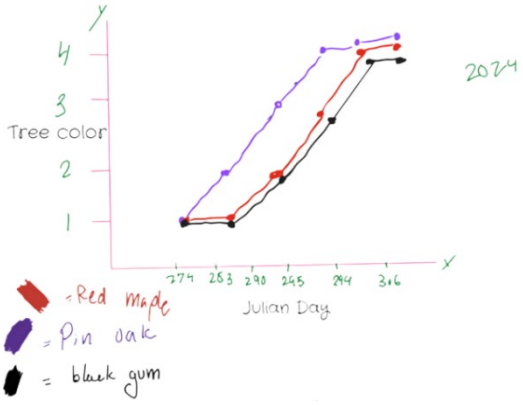
In the year 2025, the Black Gum tree lost its leaves the fastest while the Beech tree lost its leaves the slowest. The other trees like Red Maple and Pin Oak trees had dropped their leaves near the same time, around the Julian day 303 to 307. However, the Black Gum tree had lost its leaves almost ten days before the other trees. We found all our data on the Harvard Forest website from the students who took this data last year. All the trees we researched were ones near our school, but if you are planting trees in your yard, you would want to plant trees like the Exotic Cherry or Beech tree because the Beech and Cherry started losing their leaves much later than the other trees and would give you color for longer. For more diversity in falling leaves, you should pick trees like the Pin Oak, River Birch, or Red Maple. All those trees lost their leaves around the same time but not all at the same time



Sky's Research Question: How did the Red Maple, the Pin Oak, and the Black Gum's timelines for color-change compare in 2024?

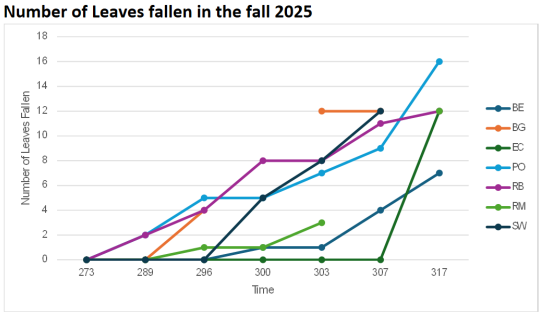
The Pin Oak with the first to turn full color. The Black Gum is usually one of the first trees to turn off the three, but, in 2024, this Pin Oak was altered by a beaver. This may have caused the Pin Oak to turn color earlier, as well as to not leaf out and force us to take data on a new tree.

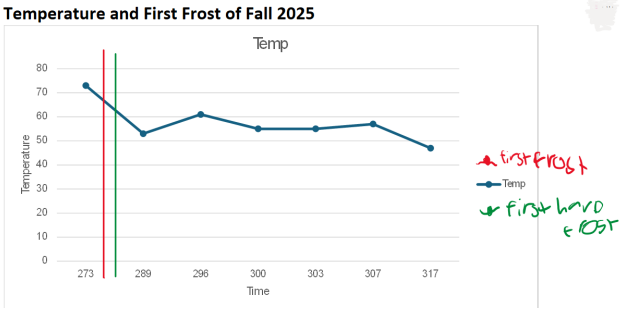
A four is the same for every tree because it is measured by how much of the tree is fully turned. However, the Pin Oak turns orange, the Black Gum turns crimson, and Red Maple turns bright red.



One of the study trees at the Williston Northampton School

Owen's Research Question: How did the temperature affect the number of leaves fallen?





Pin Oak	PO
Beech	BE
Black gum	BG
River Birch	RB
Japanese Stewartia	SW
Red Maple	RM
Exotic Cherry	EC

Analysis: The story my data tells is that there is a tiny bit of correlation between the patterns of the temperature and the leaves falling. If you look at the temperature graph, you see it follows the pattern of a slow decline in temperature. Some of the leaf falling patterns follow this rate. For example, PO follows this pattern similarly but not quite. I also added the frost dates for that fall, and I noticed that it ended up not causing a lot of leaves to fall, but I did notice that around day 296 is when the leaves started to fall. Sources say that PO and RM are known to drop their leaves early even before frost, but my data says that PO and RM dropped their leaves after the frost dates. I also learned that EC and SW are known to hold on their leaves for longer, and my data reflects this because they were some of the last ones to start dropping leaves. There were some problems with the data. For example, the BG data was incomplete, resulting in a strange direction in the movement. In conclusion, my data showed that for some tree species there is a correlation that follows the temperature closely while others do not.

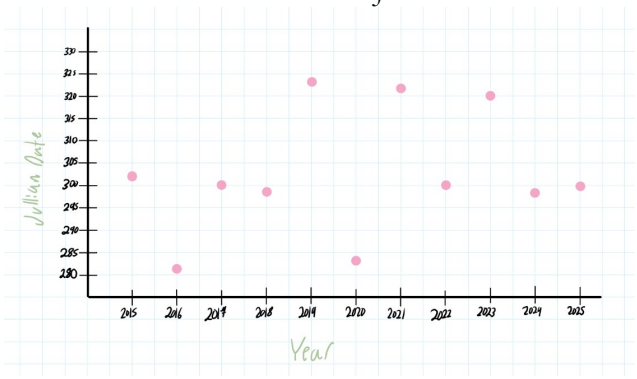
Schoolyard Profile: St. Mary's Parish School - Westfield, MA

Established in 2015 and managed by Mary Reed

St. Mary's Parish School has been participating in the Buds, Leaves & Global Warming protocol since 2015. We are an urban school and have few trees to study. All of our trees are landscaped as part of the campus. Presently, we are studying an ornamental Cherry tree, a Sweet Gum tree, a Gray Birch tree and two Paper Birch trees. During our years of study, we have also collected data on an Elm tree, an Apple tree and a third Paper Birch that are no longer with us.

Nora's Research Question: How does the first leaf fall day compare for the American Beech tree over 11 years?

American Beech Julian Dates:



Analysis: In the years 2015-2025, the Julian date was similar about 50% of the time. The consistency was on day 300 when there was average rainfall. I was hoping to see a pattern of the first day but there isn't really one. After doing some research I found out that in the years that the tree dropped its leaves later there was an above average rainfall, when they dropped their leaves earlier there was a below average rainfall and when they dropped them around day 300 there was an average rainfall. I thought this was cool because it explained why everything was kind of scattered but organized. I thought that the dates would be very different and that in 2025 the date would have been a lot later than the date in 2015 because of climate change, but they were so similar I was surprised. When I found out that they were similar because of rainfall I was even more surprised because I had never considered that rainfall might have anything to do with when trees dropped their leaves.

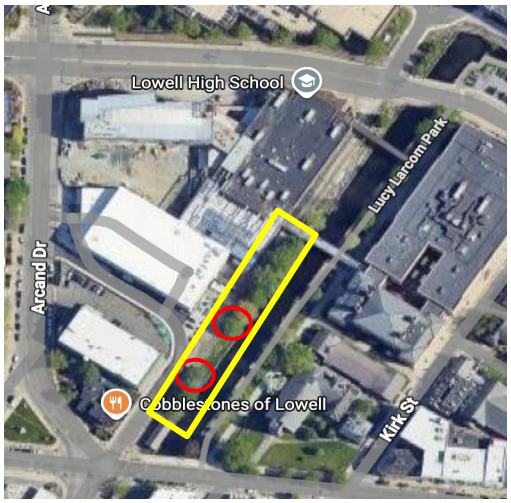
Schoolyard Profile: Lowell High School – Lowell, MA

Established in 2025 and managed by Carolyn McDonough

Located in the heart of Downtown Lowell, this plot of land houses approximately 10 mature trees nestled in between the Pawtucket Canal and Lowell High School. It also partially abuts Dutton St. and the historic trolley tracks.

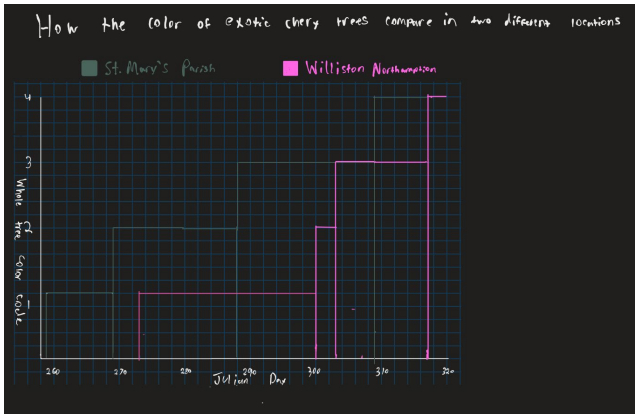
Students use this plot of land to participate in the *Buds, Leaves & Global Warming* project in the spring and fall. They collect phenology data on two mature trees: an American Basswood and a Red Maple. The plot also contains a mix of native and ornamental mature trees, including maples, oaks, and a sweetgum tree. While this is an urban, fragmented plot of land, common wildlife sightings include Gray Squirrels, Red-Tailed Hawks, Robins, Cardinals, and other local songbirds. Mallard Ducks and the occasional Great Blue Heron are common visitors to the abutting canal.

Red maple tree abutting the canal and the trolley tracks



Map of the study area highlighted in yellow with the two trees circled in red

Luke's Research Question: How do exotic Cherry trees from two different locations in Western Mass. compare?



Analysis: When comparing exotic cherry trees from two different locations, Westfield and Easthampton, I found that some trees turn color at different times but eventually even out. Looking at the graph, I can see that by the time the exotic Cherry tree from St. Mary's was already a full tree color code of 2, the exotic Cherry tree from Williston was still a 1 tree color code. This tells me that in the beginning of growth the soil can impact the speed of growth. Of course there are many other factors that also might impact this. At the end of day 317, I can see that the exotic Cherry tree at Williston evened out at the end. There are many reasons that the tree at St. Mary's got color first. This could be because of the weather, the age of the tree, or the soil. The similarity makes sense because Westfield and Easthampton are still within 20 miles.

Schoolyard Profile: Central High School – Macon, Georgia

Established in 2021 and managed by Dr. Suneetha Panda

Our plot is managed by 9th-12th graders on the STEM Team at Central High School. Our goal each year is to determine the effects of global warming on trees in the area by measuring the time and number of leaves grown in each season. Around spring and fall, we take a survey of the number of leaves as they fall and when they begin to unfurl.

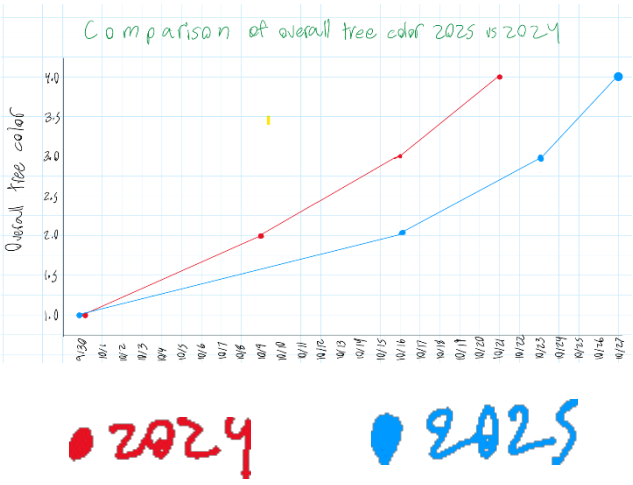
The climate in Macon, Georgia shows 2 distinct seasons of humid summers and decently cold winters. Temperatures throughout the year range from 24-80 degrees Fahrenheit.

- Study held on trees in the front of the school building
- Modified habitat
- Suburban area
- Most animals in the area are small songbirds and bug species. Many bees, wasps, and ants in the warmer months

Spring/Summer

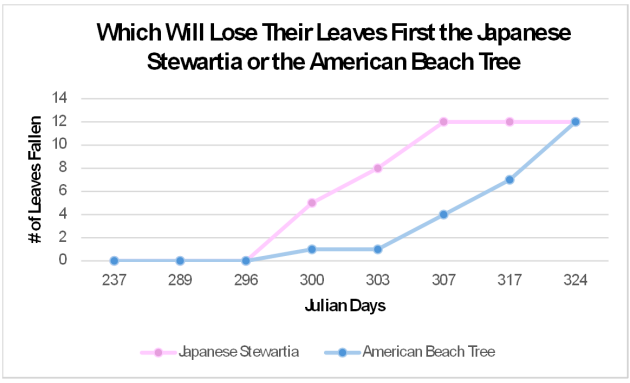
Fall/Winter

Ben's Research Question: How does this year's Pin Oak data compare to last year's Pin Oak data in overall tree color?



Analysis: The story my data tells is that the Pin Oak in 2024 changed color faster because as you can see on my graph on October 16 the Pin Oak in 2024 had an overall tree color of 3 meaning it was almost at full color and drop its leaves. On October 16 the 2025 Pin Oak tree had an overall color of 2 meaning that it was halfway to full color and dropping its leaves. The 2024 Pin Oak got to full color (4) on October 21. The 2025 Pin Oak got to full color on October 27. A way that my data story could have been affected is the warmth in 2024 vs in 2025. In 2024 it was very warm and dry which could have caused the leaves to dry up and change color faster. In 2025 it was warmer than normal, but it was moister which could have caused the leaves to change color slowly.

Liliana and Katie's Research Question: Which tree will drop all their leaves first, the Japanese Stewartia or the American Beech tree?



Analysis: In 2025, we noticed that between the Japanese Stewartia and the American Beech tree, the tree that lost all its leaves first was the Japanese Stewartia. We compared them. This is because the Japanese Stewartia "is a typical deciduous tree that drops its leaves in the autumn, often following a period of orange-red color, exposing its ornamental, exfoliating bark," while the American Beech tree is known for marcescence, (the abscission zone is not activated until the spring) a characteristic where dead, dried leaves turn a pale brown or orange-copper and remain on the branches throughout the winter. The Beech tree did lose its leaves well into the winter, and the Stewartia lost its leaves towards the beginning of the winter.

Photography submissions:

Submitted by Landon, Kohem, and Lucas of the JR Briggs Elementary School in Ashburnham

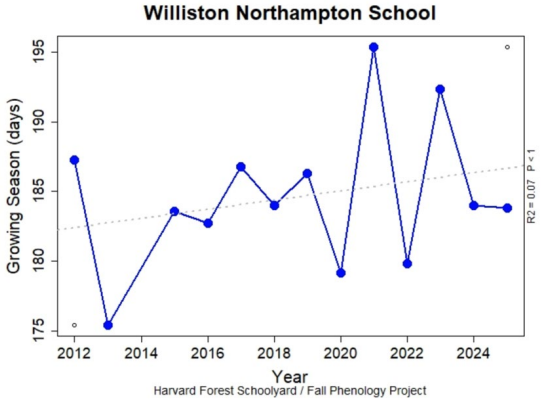
Submitted by William, Dominic, and Adelaide of the JR Briggs Elementary School in Ashburnham

Schoolyard Profile: Williston Northampton School – Easthampton, MA

Established in 2011 and managed by Jane Lucia

The research trees studied for the Buds, Leaves, and Global Warming project are located around a manmade pond, a key landscape feature of our campus. Most of the tree species studied are native to New England forests though our specimens are not in a forest. The lawn is maintained at the base of the trees and there is plenty of room for the crown of the trees to display their species characteristic shape.

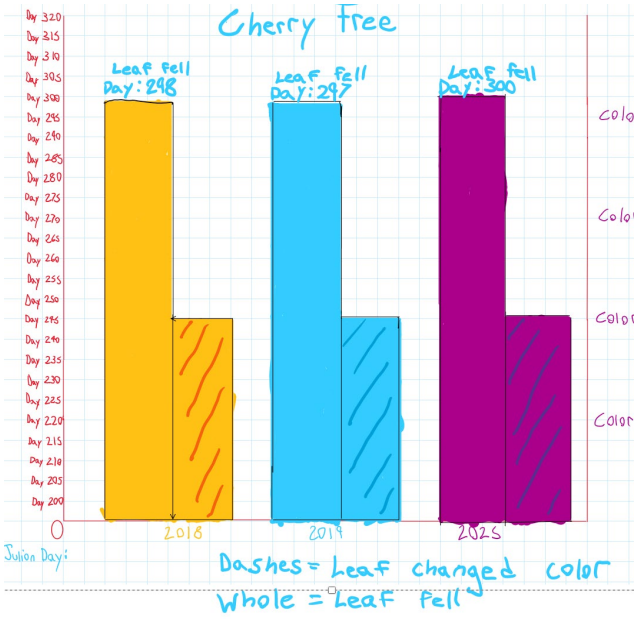
The seventh-grade students record data for seven deciduous tree species, one specimen of each species. Students observe and record leaf color change and leaf drop dates in the fall followed by budburst and leaf growth in the spring. The variety of the timing of the various species generates many curiosity questions! Students' careful observations help them identify their tree using dichotomous keys and ID books. The species we study that still have reachable branches include River Birch, American Beech, Red Maple, Black Gum, Pin Oak, Japanese Stewartia, and Japanese Cherry.



The graph of our data for all tree species suggests a slight increase in the length of the growing season over the past 15 years. The growing season length is the number of days the trees have leaves counting from the day of 50% leaf out in the spring to 50% leaf drop in the fall.

Easthampton, MA is in the Connecticut River Valley just north of Mt. Tom
Latitude: 42.3°N, Longitude 72.67°W
Elevation: 161 ft above sea level
Average annual rainfall: 45-49 inches distributed evenly throughout the year
Average temperature range: 17°F – 84°F

Jo's Research Question: Once the leaf turns color (code 2-3), how long does it take for the leaf to fall off?



Analysis: Based on the evidence above I can claim that usually when days get to two hundred and ninety or above the leaves will start falling off due to all the cold weather and rough temperatures during winter. The evidence above shows that the leaves tend to start losing their color around day 245-310 and then fall off day 297-300. I learned that the tree I was experimenting with was called EC or Cherry as I like to call it.

Williston Northampton School, Easthampton

Schoolyard Profile: Toy Town Elementary - Winchendon, MA

Established in 2009 and managed by Anne MacDonald

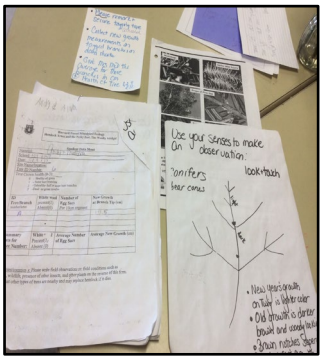
Harvard Forest Project: "The Woolly Bully: The Invasive Pest, The Hemlock Woolly Adelgid

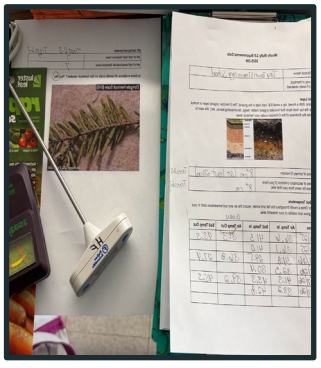
Our Hemlock Trees are managed by the fifth graders at our school. with the lead of Anne McDonald, Science teacher. Our yearly objective is to monitor the health of the Eastern Hemlock trees and inspect for the invasive species, the Woolly Adelgid. In the 2025-2026 School year, the trees were monitored by four classrooms of 5th Grade students. There are four tagged Hemlock trees. These are located in the mixed coniferous and deciduous wooded area that is in between our playground and the property of an abutting neighbor. This Fall, the abutting neighbor cut the large Hemlock trees on their property that were located behind our tagged trees. Each fall since 2009, the fifth grade students measure the new growth on our Hemlock Trees. In the Spring, they carefully observe the trees, for the presence of the woolly adelgid. As of the Spring of 2026, there is no woolly adelgid. Starting in 2025-2026, students are also collecting additional data as part of a pilot. This data includes the monthly temperature of the soil, and air, and pH level, near the Hemlock trees, and in an area away from them.

Winchendon, Massachusetts is a rural community, located in northern Worcester County, Massachusetts. It is considered to have a temperate climate, with four distinct seasons. The average elevation of Winchendon is 1,000 feet above sea level. Due to its higher elevation, Winchendon receives more snow on average than many other towns, and cities, in Massachusetts. According to historical weather data tracked by Weather Spark, temperatures typically vary between a low of 13°F in the winter to a high of 80°F in the summer.

Pictures of the Hemlock Trees on Site, data, collection sheets, and students collecting data:

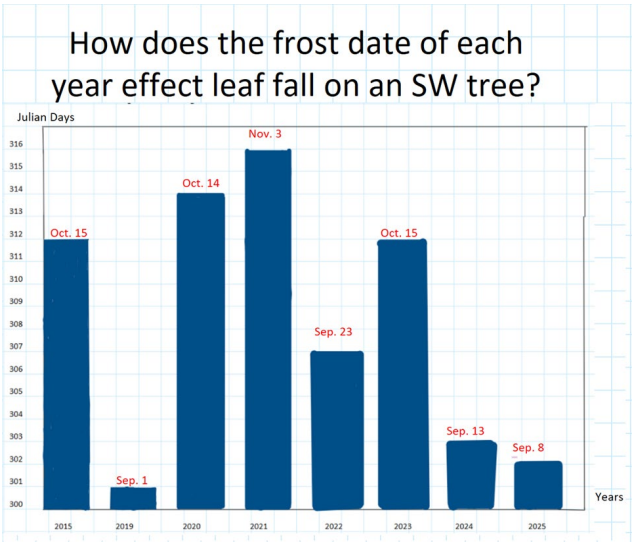
Tagged Hemlock Trees





Data Collection Sheets

Kaylee and Wynne's Research Question: How does the frost date of each year affect leaves fallen on our Stewartia tree?

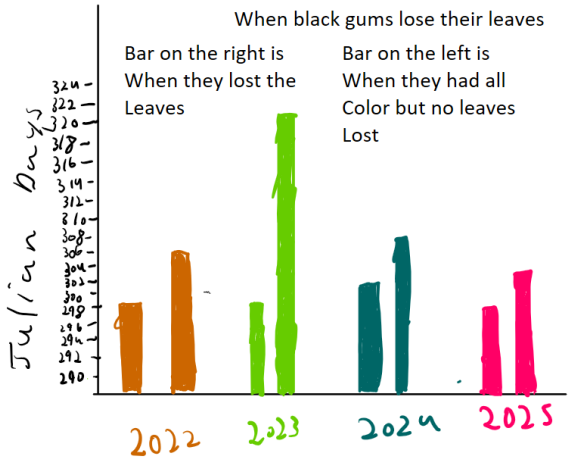


Analysis: Trees have a similar leaf fall average every year. We found that when there is an earlier frost date, leaves fall earlier, when the frost date is later, leaves fall later. For our data table we use different colors to show this; red was the frost date which means leaf fall started earlier, blue means it started later, and black was in the middle. It helps to see how frost date can change the outcome of leaf fall. We found this by looking at the latest frost date of every year. For our other process, we got data from Harvard Forest. We looked at 8 years of data. 2016-2018 didn't have data for our tree, so we used data from 2015. That way we got 10-year differences in data of leaf fall. There wasn't quite the change we were looking for.

Tree Top: By Zack, Brayden, and Gabe of Westminster Elementary

We thought there would be more of a change with temperature and rainfall. The leaf fall didn't change much as well, which can tell us that the leaf fall per year doesn't change much year for year. We can make this claim because the leaf falls within the same 20 numbers for 10 years.

Jack's Research Question: How long after the black gum turns color until it loses all its leaves?



Analysis: The data that I collected shows that the same tree over four years will have almost the same cycle in terms of timing. When it comes to when the tree had a lot of color but not a lot of leaves lost, they were all between the day 295 and 300. So the best time to look and monitor the leaf color is six days at the end of October. In 2023, it took 21 days after the leaves turned color to lose all of them because perhaps the ground was wetter which is why the graph spikes up that year. I found out that 2023 was the 5th most powerful El Nino recorded in history*.

Schoolyard Profile: Andover High School – Andover, MA

Established in 2024 and managed by Alexis Valenti

Project: Our Changing Forests

Landscape: Our site is a 10m x 10m plot on the side of a steeply sloped esker. It is located on an AVIS property called Indian Ridge near a public walking path and the Bay Circuit Trail. On the other side of the esker is a suburban neighborhood of single family homes and more AVIS-owned conservation land known as West Parish Meadow. Andover High School is less than a minute walk from the site.

Habitat: The site is typical of the other forested conservation areas near the high school. The forest floor is almost entirely covered in leaf litter, twigs, and decaying plant matter. Under the leaves is rocky soil. Low-growing plants include ferns, Maple-Leaf Viburnum, Canada Mayflower and Eastern White Pine seedlings. The presence of multi-trunked trees indicates past logging.

Trees:

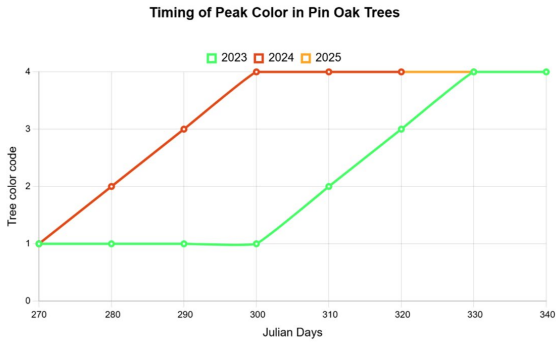
American Beech: In the fall of 2025 it had many leaves that showed Beech Leaf Disease.

Yellow Birch Hickory: There are two Hickory trees; we have not determined the species with 100% confidence.

Eastern White Pine: This young tree died between 9/24 and 9/25.

Red Maple Oak: These two trees are probably red oak and are massive; they are linked together with one trunk at the base; each individual tree has a DBH greater than 30 cm, and they dominate the canopy above.

Andrew and Bobby's Research question: When do Pin Oak Trees have the most color?



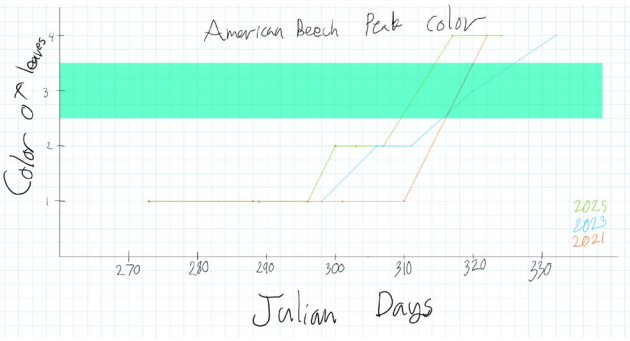
Analysis: Pin Oak peaks are beautiful, but when are they? Data and observation show these prime peaks happen between late October and very early November.

In 2023, the Pin Oak reached its peak on Julian day 311 or November 7th with a temperature of 53 degrees Fahrenheit. That data weather in general was cold and moist, which may have delayed the peak, because in 2024 and 2025, these peaks were earlier, and longer

In 2024 and 2025, peaks and overall timeline were very similar and almost identical. In 2024 the peak happened around Julian day 306 or November 1st, and in 2025 it peaked on Julian day 300 or October 27th. Even though this data was similar, the temperature at the peaks weren't, with them being 39 degrees Fahrenheit and 66 degrees Fahrenheit.

The data we collected demonstrates that Pin Oaks reach their peak color between late October and early November, usually during slightly cool weather. While the peak duration varied, the 2024 and 2025 seasons lasted longer than in 2023. We believe the 2023 peak was cut short because the temperatures were too cold, causing the color to fade quickly. Ultimately, our research shows that while the timing of the peak is consistent, the most vibrant and long-lasting colors occur when temperatures remain mild.

Catherine and Grace's Research Question: When is the American Beech at its peak color in the fall?



Analysis: The data shows us that the peak color time from 2021-25 for an American Beech is between November 7th and 15th. Peak color is when the leaves are at their most vibrant orange before falling off. Though it varies from year to year, in nature, there is no precise day due to weather like sun and rain fall. When there is less sunlight it triggers the tree to start changing color and shut down for the season. The leaves don't fall off the trees immediately so there is a little bit of leeway for visiting the beautiful forests.

Submitted by Robert, Lily, and Ayden of Westminster Elementary

Schoolyard Profile: Tolland High School – Tolland, CT

Established in Fall 2023 and managed by Kate Case

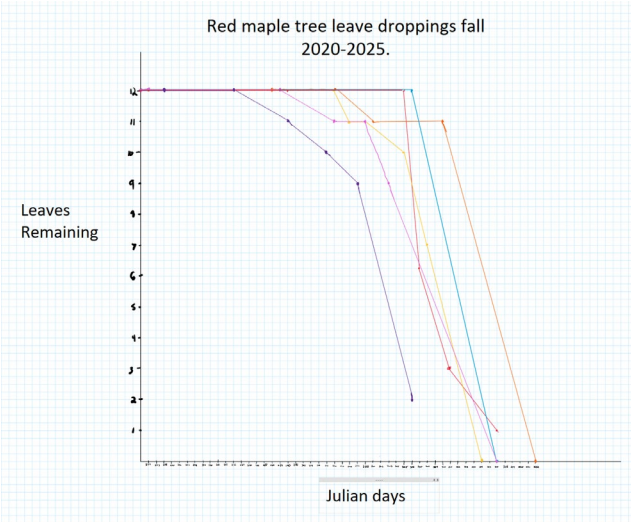
Our 10m x 10m plot is managed by 10th-12th graders at Tolland High School with the lead of Kate Case science teacher. Our yearly objective is to monitor the health of the plot but assessing for human interaction, pests, and invasive species. Each fall we measure the diameter of 13 different trees of 5 different species.

The climate of Tolland, Connecticut showcases four distinct seasons, featuring cold, snowy winters and warm to hot summers. Temperatures typically range from 18-82 degrees F. Due to its higher elevation, it is slightly cooler than nearby Hartford.

Fall	Winter	Spring	Summer
			

- Landscape Position: Dry-flat with a NE slope with some rock cover.
- Human activity: Trunked and cut trees.
- Wildlife signs: Stripped bark from deer and woodpecker holes.
- Present pests: Asian Long-Horned Beetle
- Invasive Species: No current but Autumn Olive near the plot.
- Plot: Circled in red in the photo to the right

Quinn and Charlie's Research Question: How consistently does the Red Maple tree drop its leaves in the fall?



Analysis: In the last 6 years the Red Maple tree's leaves have been dropping earlier in the last couple years than the earlier years. In 2024 and 2025 the Julian day for 50% leaves dropped was earlier. In 2025 it was at Julian day 308 and in 2024 it was at Julian day 302. At 2021's 50% leaves dropped it was the latest at Julian day 316. But 2020 was an out liar when their 50% leaves dropped point was at Julian day 307. In the years 2023 and 2021, the red maple lost all its leaves in almost 2 weeks from the time the first leave dropped. In 2023, no leaves had fallen and then all the leaves dropped at once. Compared to other years, like 2020, 2022, and 2024, they slowly lost all their leaves over about 4 weeks from the first leaf drop. Back in 2021 we had not taken any notes about the tree from 310-316. If we had, I'm sure our graph would look different. Instead of a line going straight down, it would look like steps. This is because the tree probably didn't lose all its leaves in one day, but probably over the span of 4-5. Based on this data, the red maple tends to lose all its leaves from November 6th to November 18th.

Schoolyard Profile: Mass Audubon Broad Meadow Brook – Worcester, MA

Established in 2021 and managed by Sarah Bertrand

Broad Meadow Brook Mass Audubon Sanctuary, Worcester

Broad Meadow Brook (BMB) is a 400+ acre wildlife sanctuary with well marked, accessible trails, a visitor center, and landscapes ranging from woods, fields, streams, and marshes. It is located in Worcester, MA.

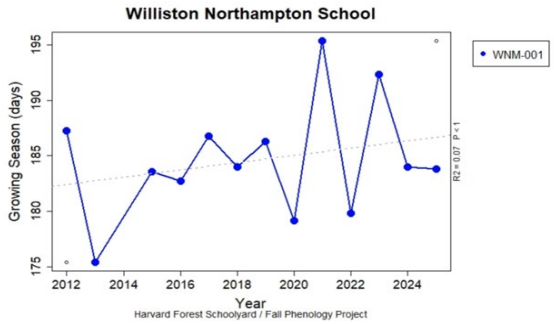
BMB has selected a few trees on the property by the visitor center to study the pace of leaf fallings in autumn and bud bursts in the spring in collaboration with Harvard Forest. Students from Worcester Technical High School have collected the data for the past four years.

The BMB site is off of Massasoit Road, just a mile away from I-90. It is an urban area, but just past the surveyed trees is a large area of the landscapes mentioned above. Songbirds are commonly found in the trees.

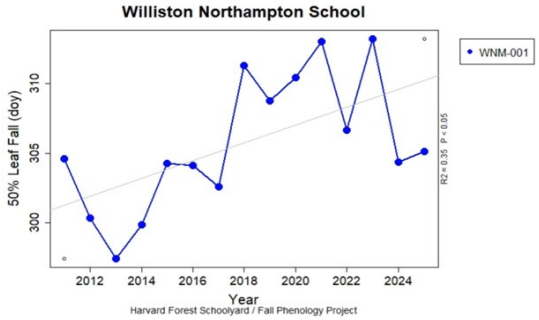
Notable surveyed tree species are Pin Oak, Flowering Dogwood, and Serviceberry.

Campbell's Research Question: How has the growing season changed at Williston?

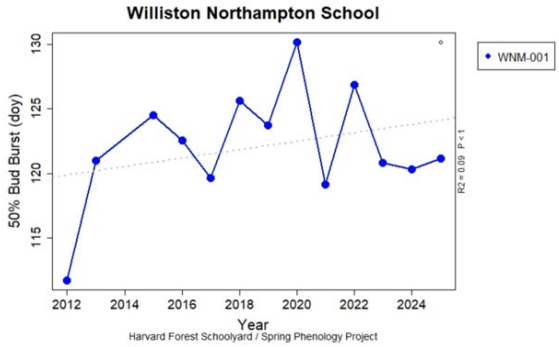
Growing Season:



50% Fall Leaf Drop Data:

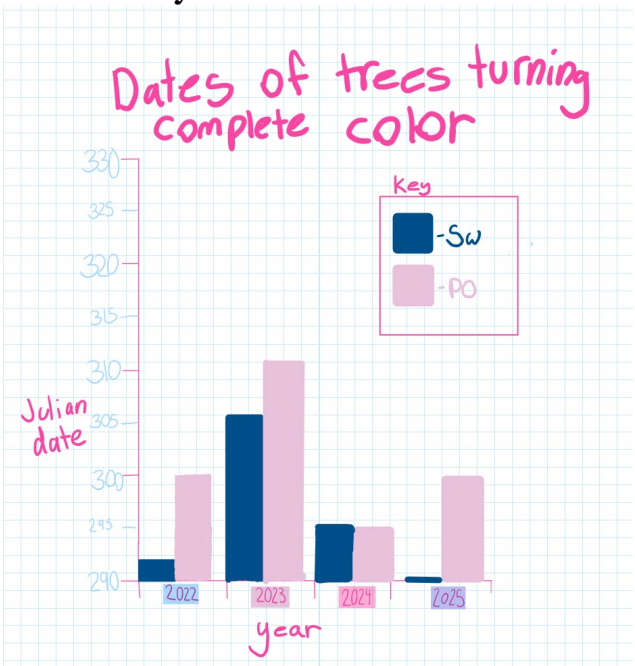


50% Bud Burst Data:



Analysis: Over the years, the growing season at Williston has changed. The growing season had gotten longer, along with the leaf drop and bud burst occurring later in the year too. But if both the leaf drop and bud burst are happening later, why is the season getting longer? If both happen later, then it still should be even. To answer this question, we look at the 50% Leaf Drop data and the 50% Bud Burst data graphs. For both the Leaf Drop and Bud Burst data, we went outside and observed our trees. We measured when the leaves fell off the tree branches for the Leaf Drop, and when the leaves budded out on trees for the Bud Burst. By finding the averages for both the Leaf Drop and Bud Burst data, we were able to make a trendline showing the change in when the average Leaf Drop and Bud Bursts were happening. The inclines in both graphs show that the midway points of the Leaf Drop and Bud Burst are occurring later in the year than previous years. After comparing the trend line on both graphs, we can see that while both are occurring later in the year, the halfway date of the Leaf Drop is pushing back more rapidly, which causes the growing season at Williston to be longer than in previous years.

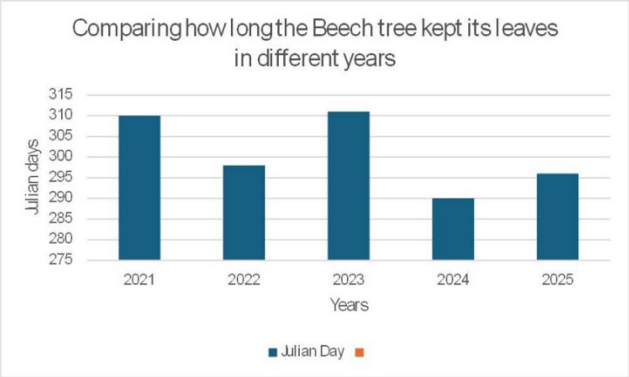
Jay and Annabel's Research Question: How do the Julian dates of the Japanese Stewartia and Pin Oak reaching full color, compare over four years?

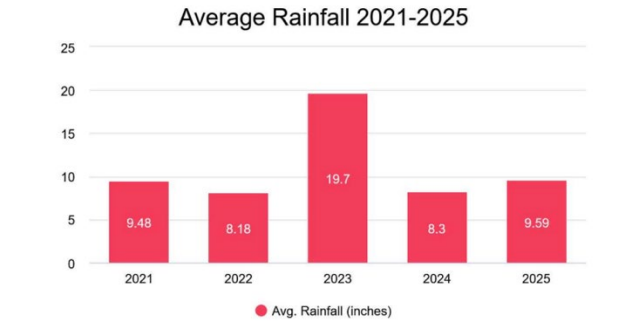


Analysis: Our data showed that the Japanese Stewartia was fully color changed quicker than the pin oak, each year we measured. We took the Julian dates from the typical dates that the Stewartia tree turned full color and compared it in a bar graph to the Pin Oak. The system we used to tell the color of a tree, is ranking it from 1-4. 1 being green and healthy leaves, with 4 being bright red, fully colored to almost dead leaves. We took all the dates that the trees originally turned to 4 and compared them. 2024 was the only year that the trees turned full color on the same date, all the other years the Stewartia turned full color quicker. In 2024, the Pin Oak changed significantly earlier compared to the other years. This could have been caused by the fact that in that year the Pin Oak we were using for data had been chewed on by a beaver which led to the tree's death, so the next year we took data from a new Pin Oak. All this data could be helpful to know because it gives us a better sense of how these trees compare to each other. A follow up question could be the same data exploration but comparing other trees.

Wyatt and Aedan's Research Question: When does the Beech tree lose its leaves in different years?

Analysis: In the five years we tested we found fairly consistent data, although, the years 2023 and 2024 stand out the most. In 2023 the final Julian day before the Beech tree lost a leaf was the 311th day of the year, while in 2024 it was the 290th. All of the other years lost a leaf around the 300th day, so it was strange to see a three-week gap from 2023-2024. We looked at the weather in the summers of those years and found that the average precipitation was very different. In the summer of 2023 around 20 inches of rain fell while in 2024 it was around 8. This data has brought us to the conclusion that the amount of water available to the tree can change when the Beech loses its leaves.





Art Submission

Artwork submitted by Amiyah Boseman French of the Madison Park Technical High School in Boston, MA