

Effects of Temperature Readings on Sugar Maple (*Acer saccharum*) Sap Flow



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Introduction

- Temperature has been found to have significant effect on sap flow
- Differences in sap flows are observed to be more closely related to overnight temperatures than during the day
- Warmer air and soil temperature have been found to have a positive effect on sap flow

Research Question: How does soil, air, and surface temperature affect sap flow in sugar maple trees?

Methods

- Tapped 6 trees in various areas of Big Hill Park and gathered data on 3 days from late February to early March 2023
- Measured diameter at breast height (DBH) by gathering tree circumference using yarn and a meter stick
- Gathered air temperature using the GLOBE Atmosphere protocols
- Used GLOBE Pedosphere protocols to gather soil temperature, tested it 3 times, 25 cm apart at 5 and 10 cm soil depth for each tree
- Used an infrared surface thermometer to gather the tree temperature from the spile and opposite side
- Gathered sap weight by using a weighing scale, later measured volume with a gallon bottle

Results

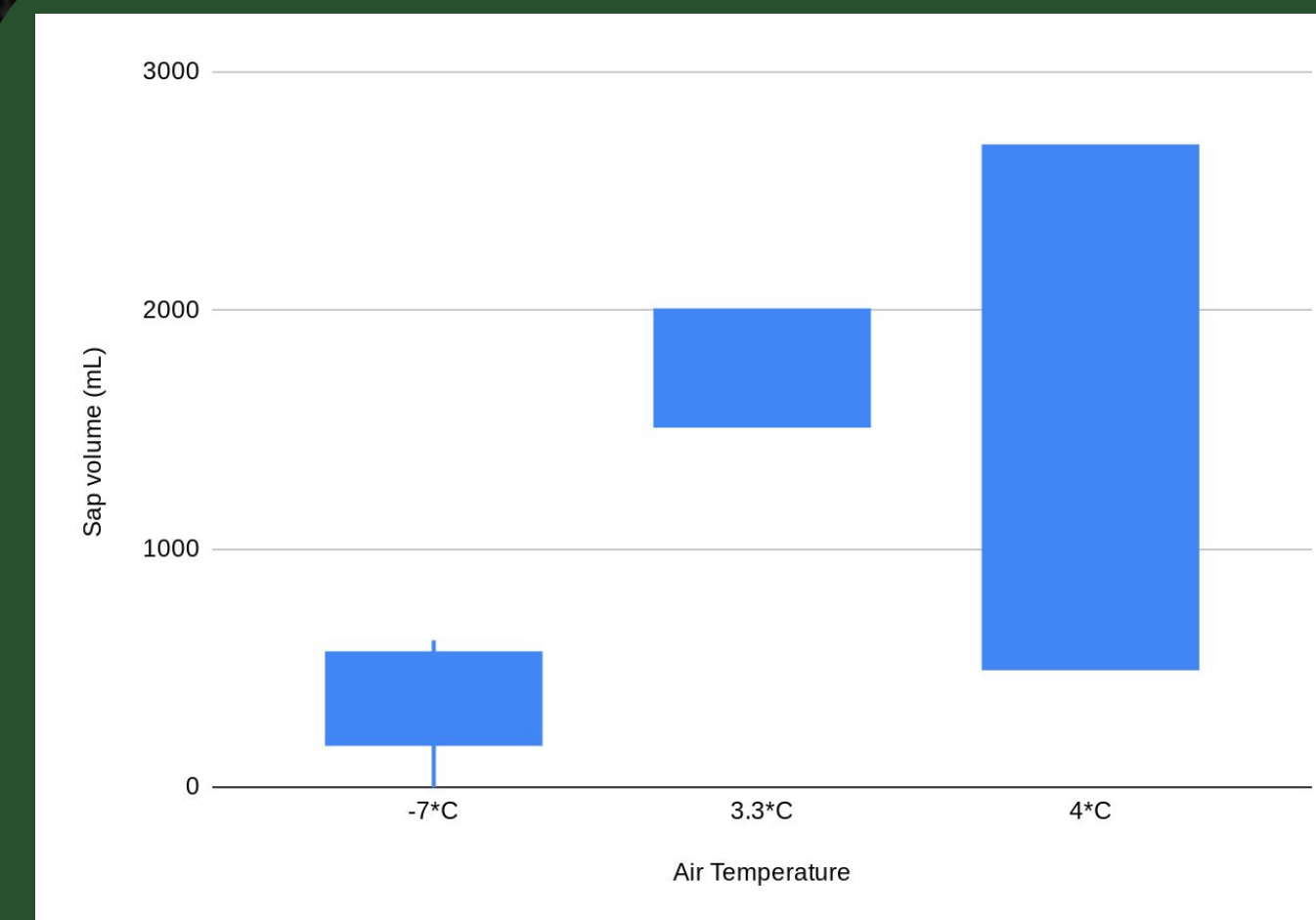


Figure 1: Sap volume based on the various days of air temperature recorded.

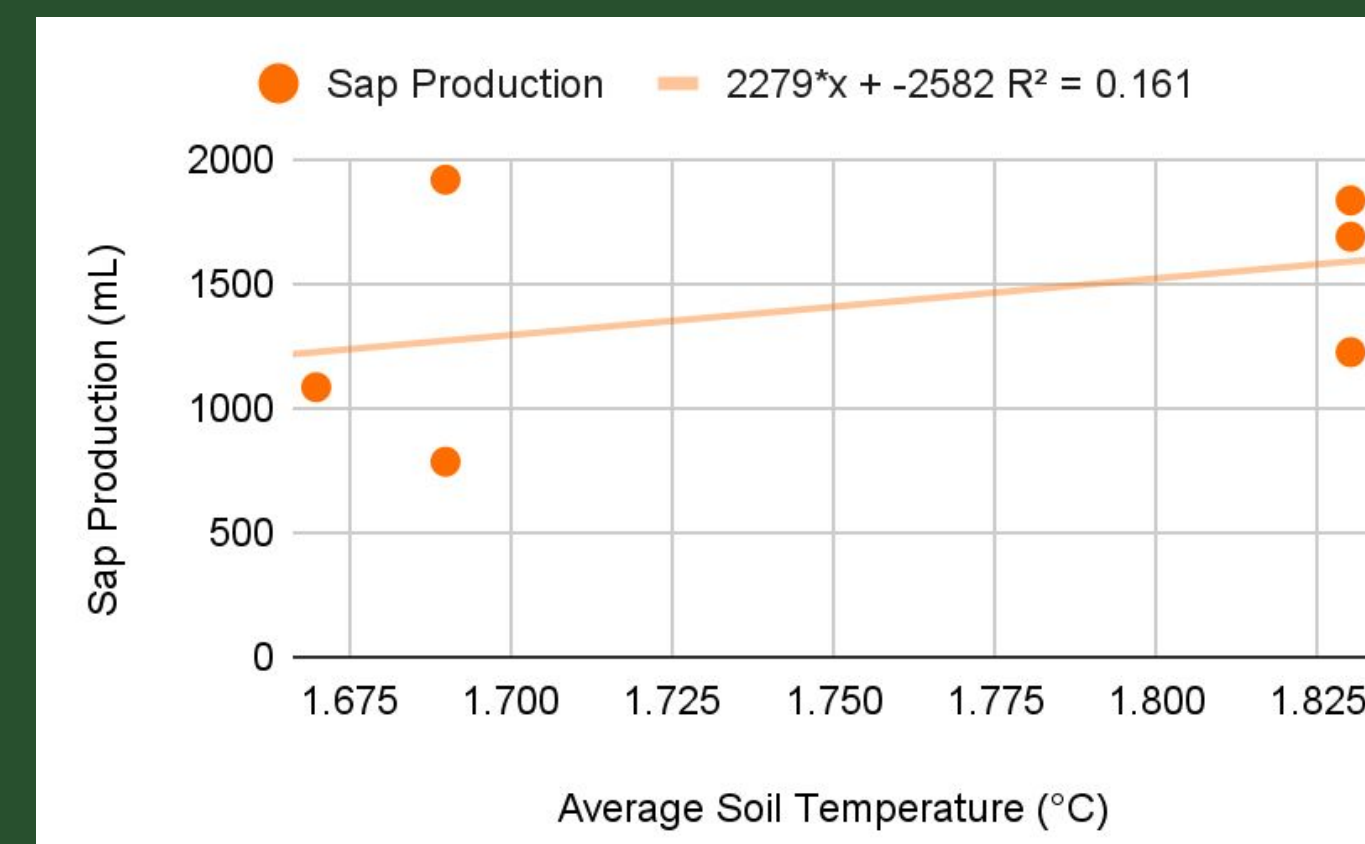


Figure 2: The relationship between average soil temperatures and sap production. The R^2 shows the strength of the relationship on a scale of 0-1.

- Sap flow increases as soil and tree temperature increases
- Soil temperature has a higher trendline than tree temperature

- Cold days reduce the amount of sap flow
- Warm days cause a more unpredictable amount of sap flow

Table 1: The relationship of DBH of different trees to amount of sap produced.

Tree ID	DBH (in)	Sap Production (mL)		
		Average	Minimum	Maximum
SO1	30.45	1104.87	250	2000
SY2	13.79	1223.25	368	2250
SY3	13.91	1777.67	183	4650
SY4	14.04	1583.33	0	4000
SY5	12.53	782.75	250	1800
SY6	15.04	1889	617	4250

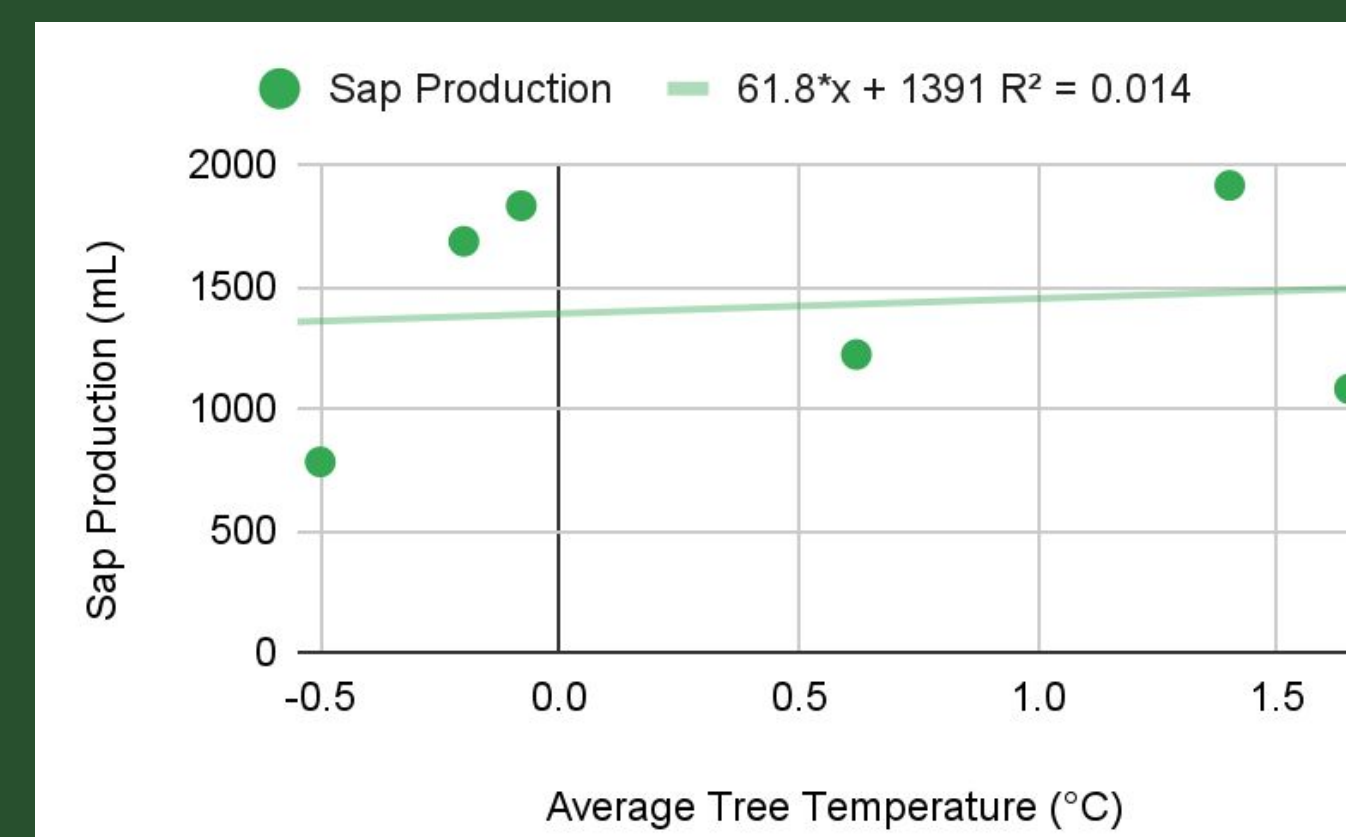


Figure 3: The relationship between average tree temperatures and sap production. The R^2 shows the strength of the relationship on a scale of 0-1.

Discussion

- Higher soil temperatures show to have a greater contribution to sap flow than tree temperature
- Sap comes from the roots, so it makes sense that the soil has to be warm to be able to melt the snow to dissolve the starch to produce sap
- Drastic changes in day-night temperature appear to be more effective for the most sap flow
- Sap flow doesn't show to be affected by DBH; some smaller trees produced more sap

Limitations

- Time had an affect on our research as maple season only lasts a couple weeks
- There were many snow days; we would have to empty the old sap and restart to ensure it was gathered in a 24hr period
- Using a regular scale wasn't very effective at first; it didn't measure the true amount
- Day one of sap collection isn't comparable due to the scale having a weight limit of 2000g



Conclusion

- Possible future research could be collecting overnight data, investigating the impact it has on the rate of sap flow
- During this internship, I was able to get more experience on methods of collecting data and research. Being able to be out in the field collecting data was very exciting for me. It also helped me come to a greater understanding of my research as time passed.

Acknowledgements

I would like to show thanks to:

- The National Science Foundation (GEOPATHS Award #2118482) for funding
- Michael Notaro at the UW-Madison Center for Climatic Research at the Nelson Institute
- Darien Becker and Aaron Wilson at the Welty Environmental Center for field assistance and logistical support