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Katherine Banovetz

College of Saint Benedict/Saint John's University, KMBANOVETZ@CSBSJU.EDU

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The Relationship Between Barometric Pressure and Maple Sap Flow



Kate Banovetz. College of St. Benedict/St. John's University, Biology Department, Collegetown, MN 56321
[kmbanovetz@csbsju.edu; (612)270-4335]

Introduction

Maple sap flows out of trees under special environmental conditions. Sap flow requires cool nights below freezing with warm days following. During the below freezing nights, the stem pressure decreases and the stem absorbs water up the tree. As the temperature continues to decline, the water freezes along the inside of the walls. Then as the temperature warms, the ice melts and ice-compressed gases expand forcing the sap out of the stem. In this process, temperature and pressure are important for maple sap flow. Pressure flows from high pressure to low pressure. If the pressure outside of the maple tree is lower than inside of the tree, then sap will want to leave the tree to lower pressure. Based on this information, our hypothesis states that the lower the barometric pressure, the more maple sap flows out of the tree.

Purpose

The purpose of this project is to analyze the relationship between barometric pressure and maple sap flow.



Methods

Obtain record of sap flow days and amount of sap flow collected on those days of Saint John's Maple Syrup from 2012-2016. Find barometric pressure of each maple sap flow days for every hour between 12pm and 6pm for each year. Take the average of the barometric pressure during the time range. A maple sap flow day is defined as the day maple sap was recorded and the prior day. Find average barometric pressure of each month. Find barometric pressure difference for each month and each year by subtracting the daily barometric pressure of a maple sap flow day by the average barometric pressure of the month. Find the percent of gallons recorded for each maple sap flow day by dividing the amount of maple sap for a specific day by the total maple sap flow for that year. Analyze graphs to find if there is a relationship between barometric pressure and maple sap flow.

Results/Discussion

The graphs show no pattern resulting in no relationship between barometric pressure and maple sap flow.

- Figure 1 shows no correlation between barometric pressure difference and maple sap flow
- Figure 2 shows no relationship between barometric pressure difference and percent maple sap flow
- Figure 3 does not show a correlation with barometric pressure and sap flow. If there was a correlation, the negative barometric pressure differences would have the highest sap flow.
- The relationship between the barometric pressure on sap flow days (inHg) and the percent sap flow (gallons) on those specific days (figure 4) shows no relationship.

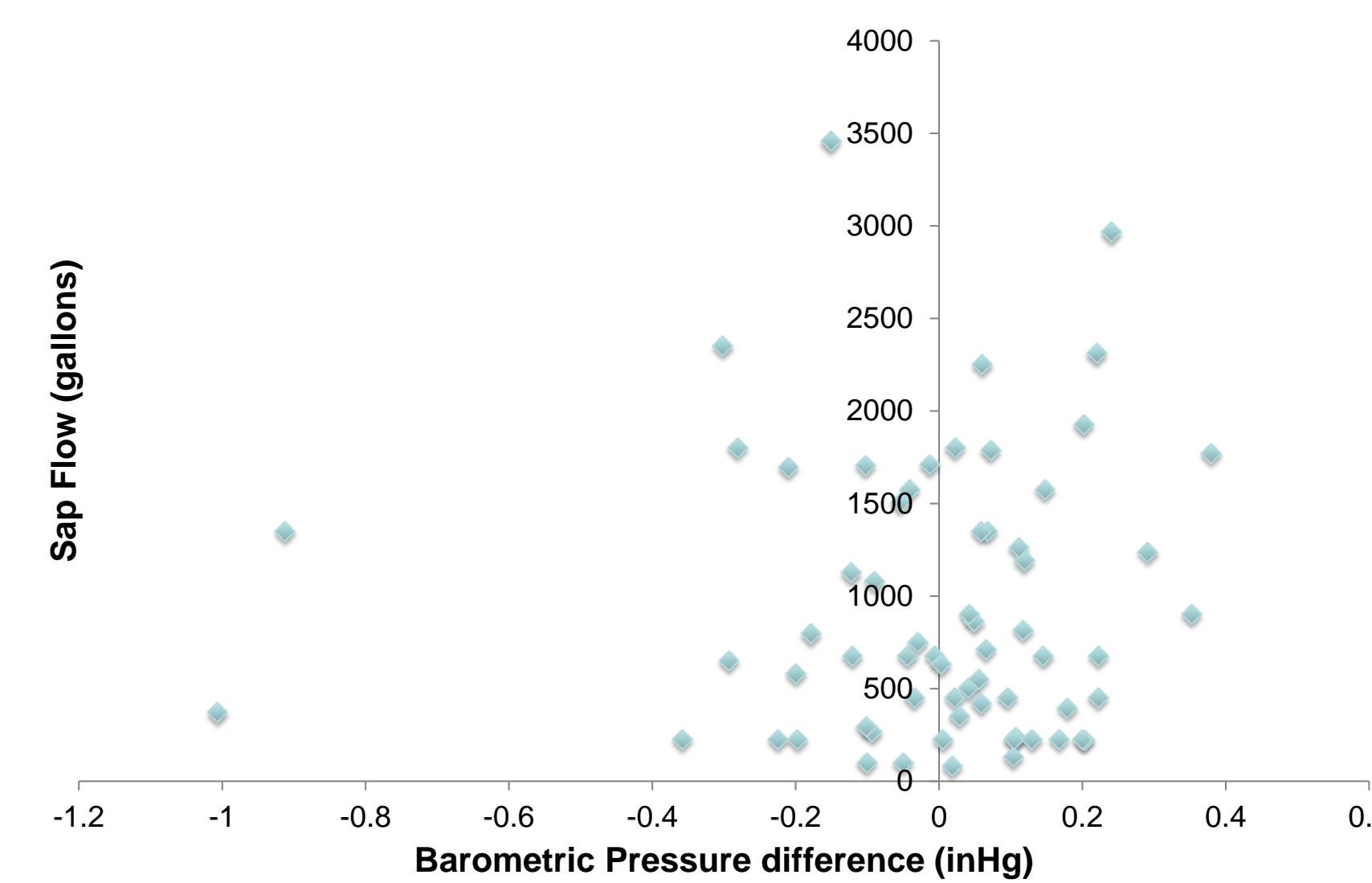


Figure 1. The relationship between the barometric pressure difference (daily-mean) in inHg of sap flow days and the sap flow in gallons.

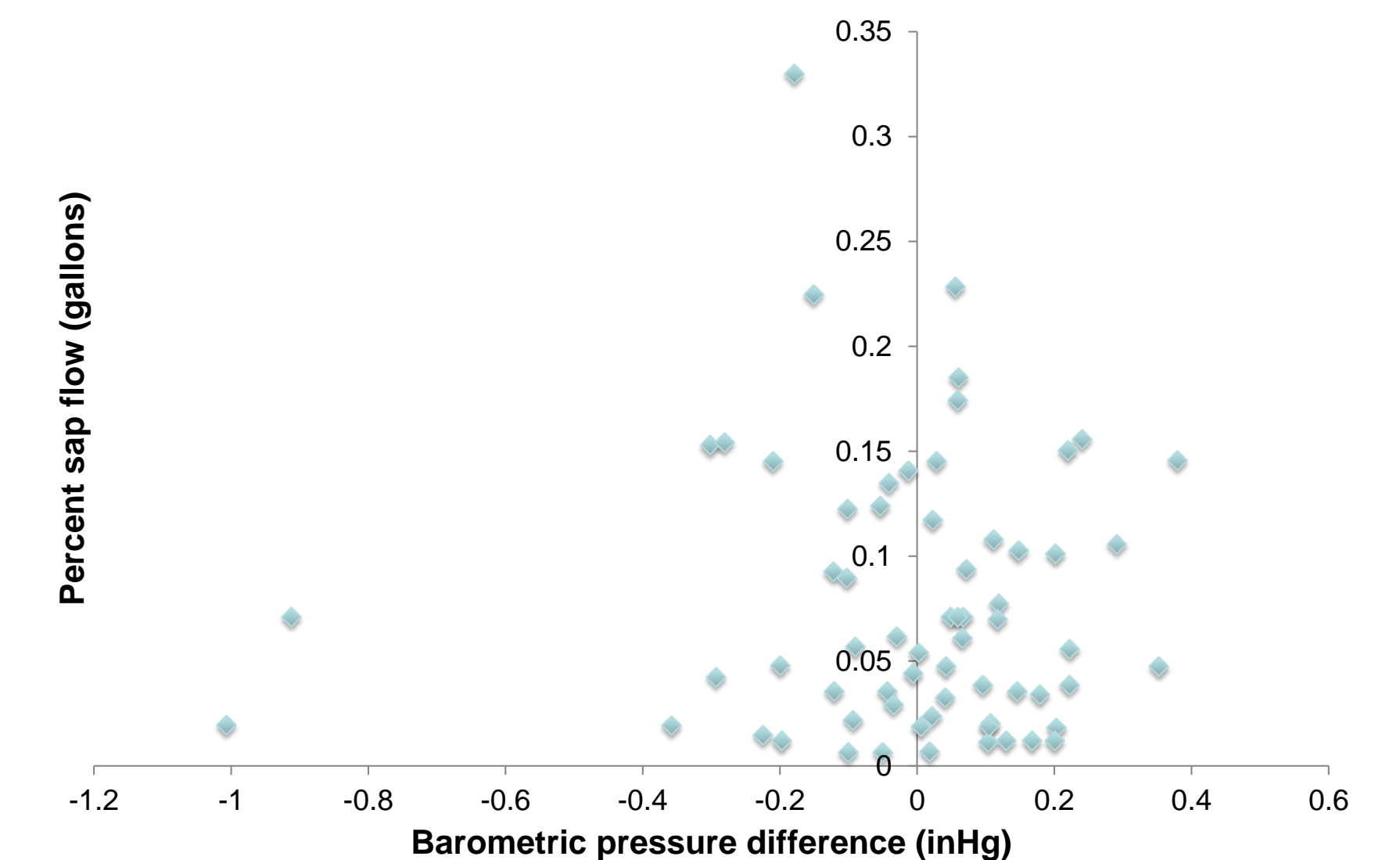


Figure 2. The relationship between the barometric pressure difference (daily-mean) in inHg and the percent sap flow in gallons.

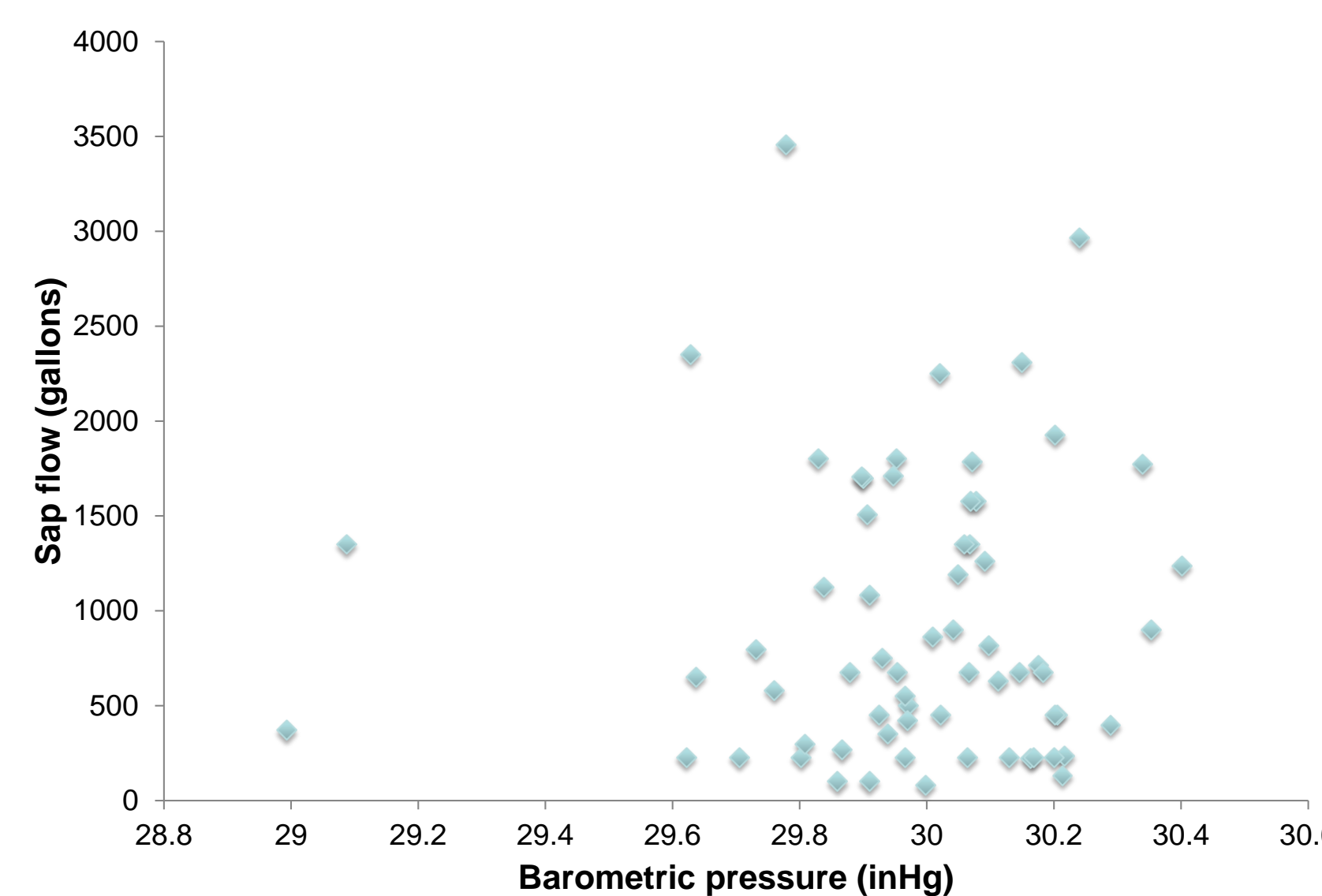


Figure 3. The relationship between barometric pressure (inHg) of sap flow days and the amount of sap flow (gallons) on those specific days.

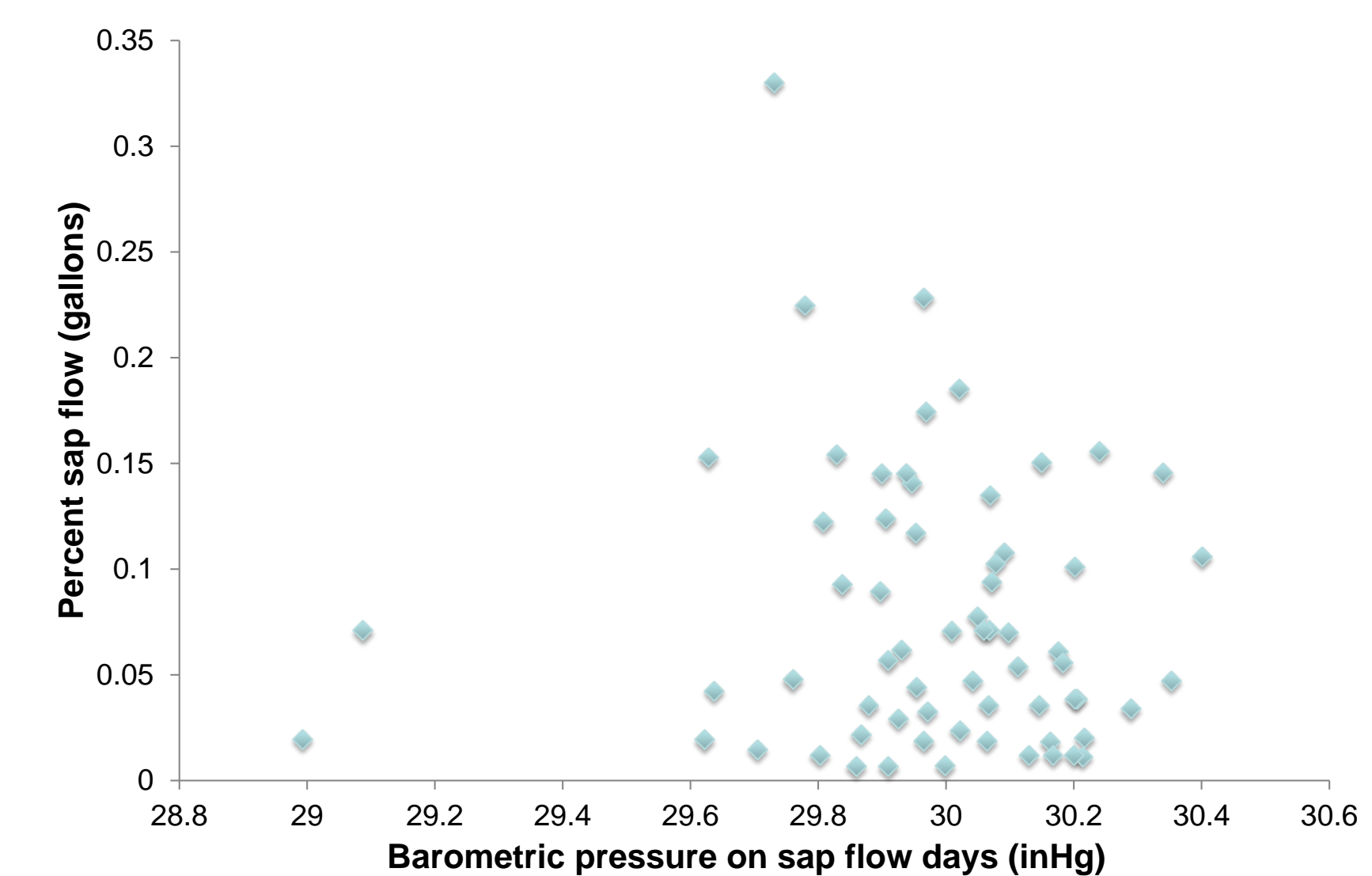


Figure 4. The relationship between the barometric pressure on sap flow days (inHg) and the percent sap flow (gallons) on those specific days.

Conclusion

Based on the results, we can conclude that there is no relationship between barometric pressure and maple sap flow. This might have been caused by not having a definite understanding when sap flow came out of the tree. We recorded how much sap was collected on each day but the sap might have run out of the tree the day before and was not collected until the next day. Another reason that might have caused no correlation is that the pressure difference between days is very small. It is difficult to make a correlation or find results with a very narrow range of barometric pressure. With that, I conclude that other factors have a greater impact on maple sap flow than barometric pressure.