

Edina Trust Bulb Project Extension Report for Teachers and Project Leaders

A big thank you!

Well done to all schools that sent data for the Bulb Project this year! Your input has been invaluable in looking at our hypotheses. Even if you did not manage to get data to us this year we hope that this project has been fun and useful for teaching various curriculum topics. We have a **quick survey online** where we would love to get your feedback:

<https://www.surveymonkey.co.uk/r/EdinaBulbs2017>

The National Museum of Wales (NMW) will produce a paper on the results of the bulbs planted in pots for all schools. This will be distributed to the schools involved and can be accessed on the NMW website: www.museumwales.ac.uk/spring-bulbs/

This year 101 schools took part in the Edina Trust's extension Bulb Project, which involves comparing the flowering dates and heights between bulbs planted in pots and bulbs planted in the ground. This year the Trust received flowering results from roughly 4 in 10 schools taking part. While this is an improvement on previous years, we hope more schools return their flowering results in future so that we can improve our analysis. **A big thank you to the schools that returned their flowering data!**

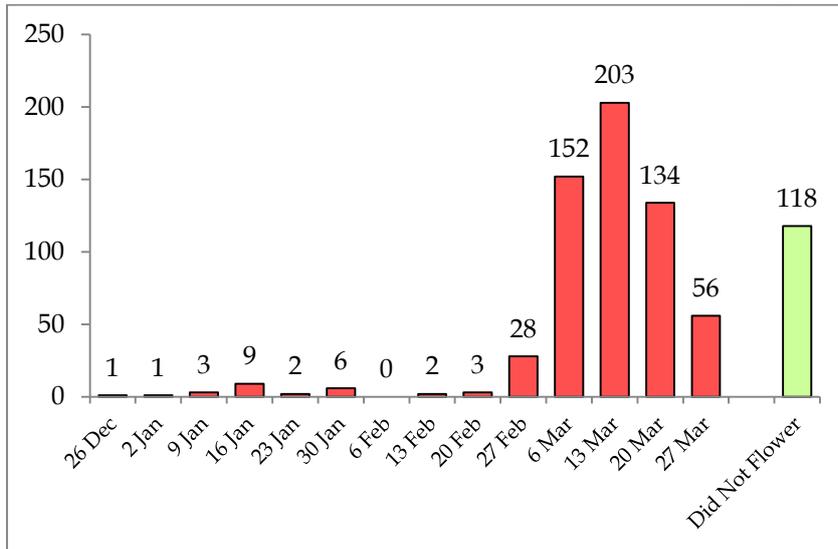
Table 1: Data sets for the Edina Trust Bulb Project Evaluation

	Schools in Extension Project	Schools in Scotland	Schools in England	Schools in Wales
All Schools	101	52	44	5
Schools that provided flowering data on bulbs in the ground. They will be referred to in this paper as "our special schools".	42 (42%)	16 (31%)	23 (52%)	3 (60%)
Schools that provided flowering data on bulbs in the ground AND bulbs in pots. They will be referred to as "our very special schools".	31 (31%)	11 (21%)	18 (41%)	2 (40%)

Our 42 special schools provided flowering dates and heights for 600 daffodils planted in the ground, as well as recording a total of 118 bulbs that did not flower before the end of the project. In the following analysis, local authorities have been divided into three regions:

- **Scotland:** Fife, North Ayrshire, North Lanarkshire, Renfrewshire, Scottish Borders, South Lanarkshire, West Dunbartonshire.
- **North England:** Lancashire, Middlesbrough, Sunderland
- **South England/Wales:** Conwy, Lincolnshire, Oxfordshire, Rhondda Cynon Taf

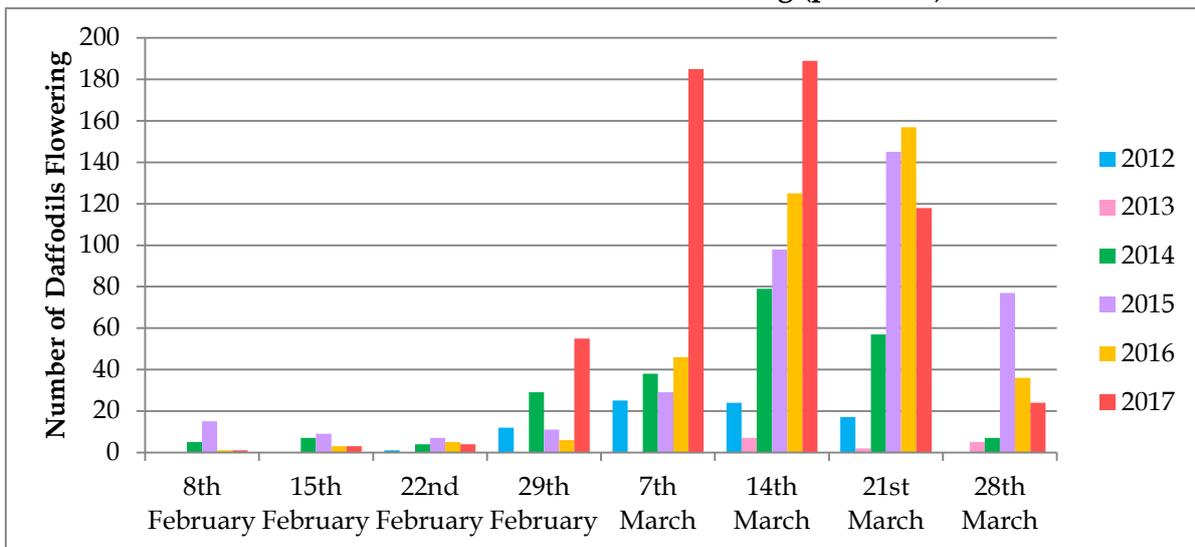
Chart 1: Number of Daffodils vs Date of Flowering (per week) – Jan-March 2017



Source information:
 Chart shows the number of daffodils flowering in weeks beginning 26th December until 31st March. Our special schools also reported 3 bulbs that flowered after the cut-off date of 31st March, which are included in the 'Did Not Flower' bar.

Chart 1 shows that the majority of the daffodils flowered in March this year. This includes daffodils planted in the ground from all of our areas.

Chart 2: Number of Daffodils vs Date of Flowering (per week) – 2012-2017



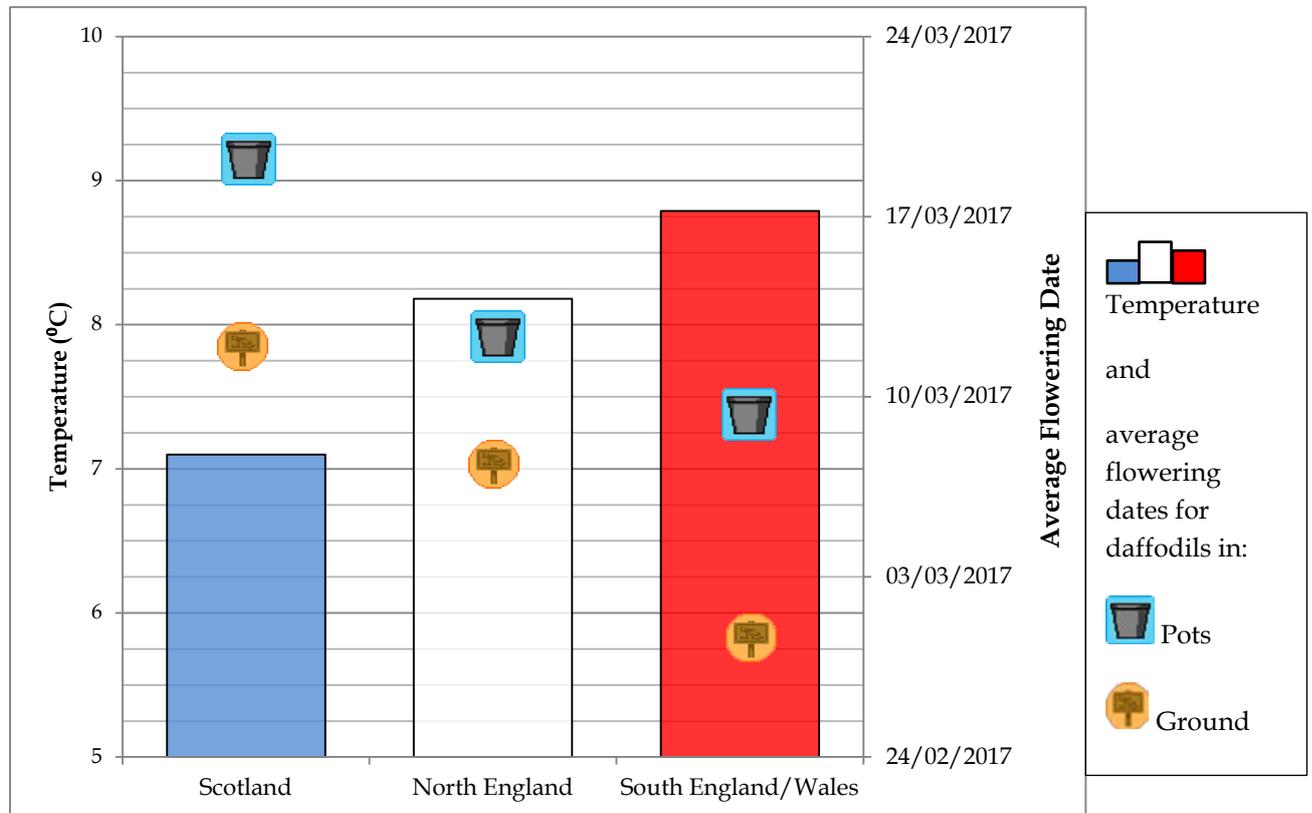
Source information: Data from all five years of the Bulb Project, since 2011-12. As the project ends at different times each year (depending on Easter), flowers reported after the cut-off date (31st March) this year are shown on this chart. There were 22 flowers in January 2017 not included on this chart.

Chart 2 shows the following:

- Most daffodils flower in March every year.
- In 2013 and 2015 the flowering dates were delayed due to the widespread cold weather, with many daffodils reported to have flowered in April.
- In 2017 the most common weeks for daffodils to open were the first two weeks of March, probably due to the mild winter.

Hypothesis 1: Schools that record higher temperatures during the Bulb Project will have the earliest flowering daffodils. The effect of temperature will be more pronounced with the daffodils in pots compared to those in the ground.

Chart 3: Average flowering date and average temperature – by area.



Source information: The flowering date only includes data from our very special schools that sent in flowering information for both bulbs in the ground and in pots. The weather recordings are from the 82 schools that sent in weather recordings.

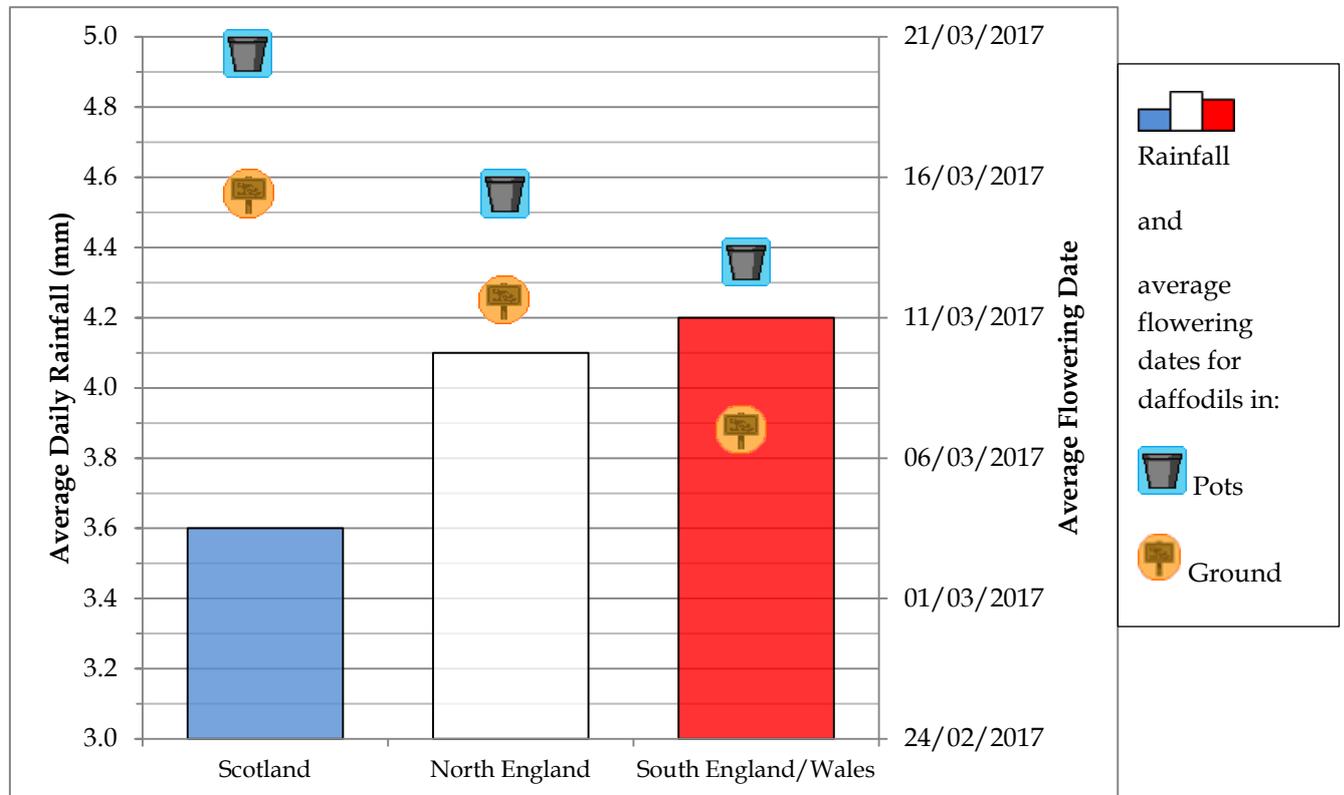
In all three regions, the daffodils planted in the ground flowered earlier than those planted in pots. Flowers in South England/Wales opened first, and flowers in Scotland opened last. This does correlate with the hypothesis as South England/Wales had the highest temperatures and the earliest-flowering daffodils. A statistical test looking at the correlation showed a slight negative correlation that was stronger for bulbs in pots. However it was not a strong enough correlation to show to be significant for the amount of data we analysed. **The data from the project this year cannot support our hypothesis.**

While we know that temperature does affect the flowering date of daffodils¹, there are other factors that can have a stronger effect. For example, when schools planted their bulbs we asked for a location, including whether they were planted in a shaded area. Sunlight, soil quality, rainfall, and pests could be contributing to the flowering date. It could also be affected by schools measuring the temperature at different times of day. We would need to make the Bulb Project a lot stricter if we wanted to account for these.

¹ See, for example, Khodorova & Boitel-Conti, *The Role of Temperature in the Growth and Flowering of Geophytes*; Plants 2013, 2, 699-711; <http://www.mdpi.com/2223-7747/2/4/699/pdf>

Hypothesis 2: Schools that record more daily rainfall during the Bulb Project will have the earliest flowering daffodils.

Chart 4: Average flowering date and average daily rainfall – by area.



Source information: The flowering date only includes data from our very special schools that sent in flowering information for both bulbs in the ground and in pots. The weather recordings are from the 82 schools that sent in weather recordings.

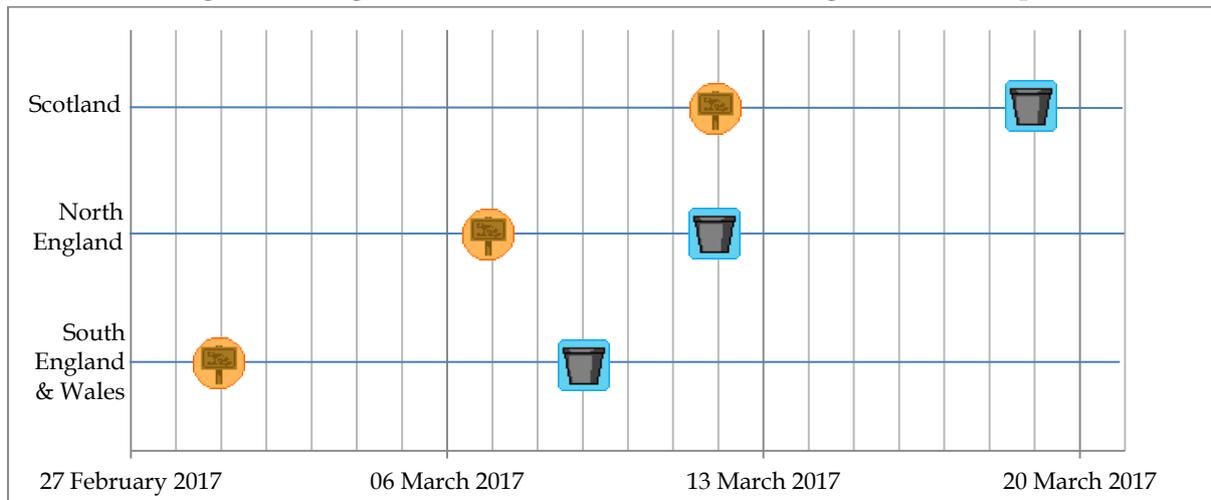
Again **there is a pattern when looking at average daily rainfall and the average flowering date**. Scotland had the least amount of rain per day while South England/Wales had the most. Scotland had the latest flowering dates while South England/Wales had the earliest. North England was in the middle for both rainfall and flowering date.

A statistical test looking at the correlation between the number of days until the daffodils flowered and the average daily rainfall recorded by each school showed that **there was not a statistically significant correlation**. This is based on the amount of data available. There was a greater correlation for the bulbs planted in the ground than for bulbs planted in pots, but it was not strong enough to say it supports the hypothesis.

One additional point to note is that plants can have too much water! In previous years of the Bulb Project this has been demonstrated in areas that had an exceptionally high amount of rain, where schools reported their daffodils flowering later than areas with normal rainfall. This year schools reported a fairly average amount of rain compared to the previous six years of the project.

Hypothesis 3: On average, daffodils in pots will flower before those planted in the ground.

Chart 5: Average flowering dates in each area, for bulbs in the ground and in pots.



Source information: This data comes from our 31 very special schools that returned data for both bulbs in the ground and those in pots.

We think bulbs planted in pots will normally flower first because bulbs in the ground are better insulated from changes in temperature and therefore take longer to ‘wake up’ when the weather gets warm. **However, Chart 5 shows the opposite of our hypothesis, with bulbs in the ground flowering first in all areas!** We are not sure why this happened, as the weather recordings from schools were not much different from those in previous years.

45% of schools reported that they had planted their bulbs in a different location to where the bulbs in pots were kept, so it could be because bulbs in pots were being kept in more sheltered areas e.g. close to a heated building in some schools. We do hear of bulbs in pots being brought indoors or watered more than those in the ground sometimes. We would be interested to hear if this happened in your school.

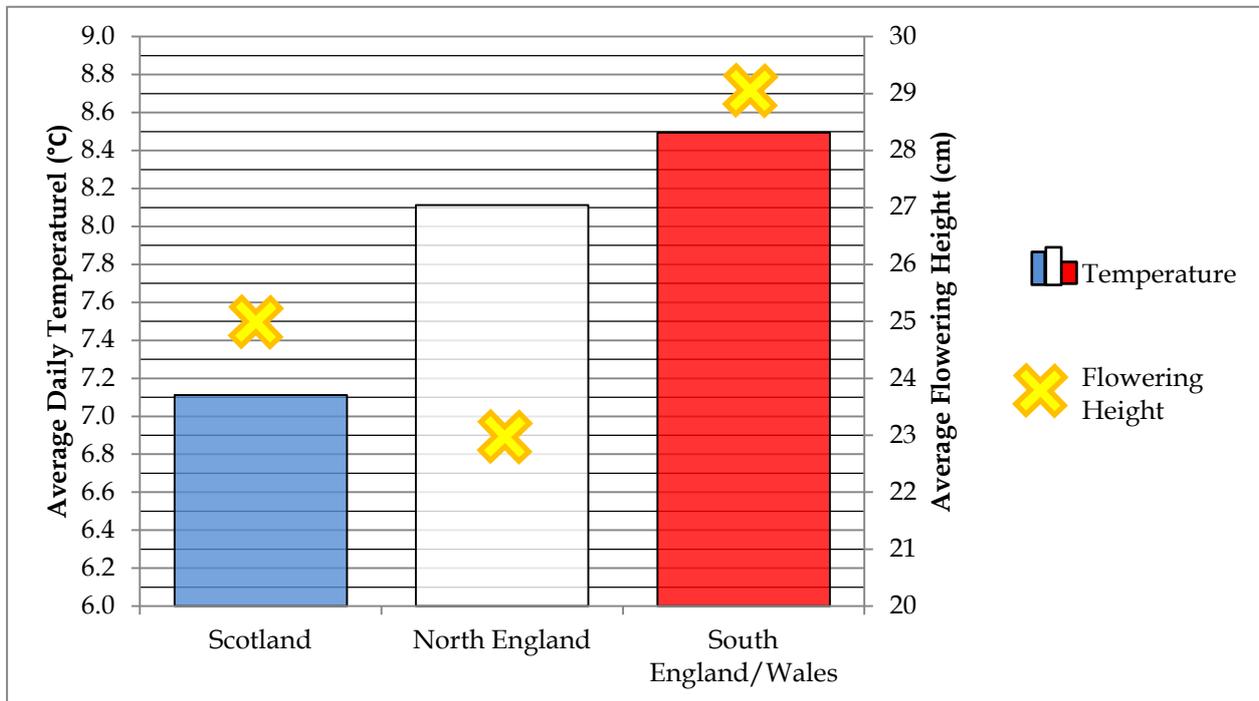
The average flowering dates across all areas were:

- 13th March for bulbs planted in pots.
- 6th March for bulbs planted in the ground.

This means there was a difference of seven days between the averages of our two sets of data. A statistical test showed that this is not a significant difference, and as in hypothesis 1, maybe other aspects that weren’t measured had a strong effect that meant whether the bulb was planted in a pot or in the ground was not the deciding factor for flowering date.

Hypothesis 4: Schools in areas with higher temperatures will record taller daffodil flowering heights.

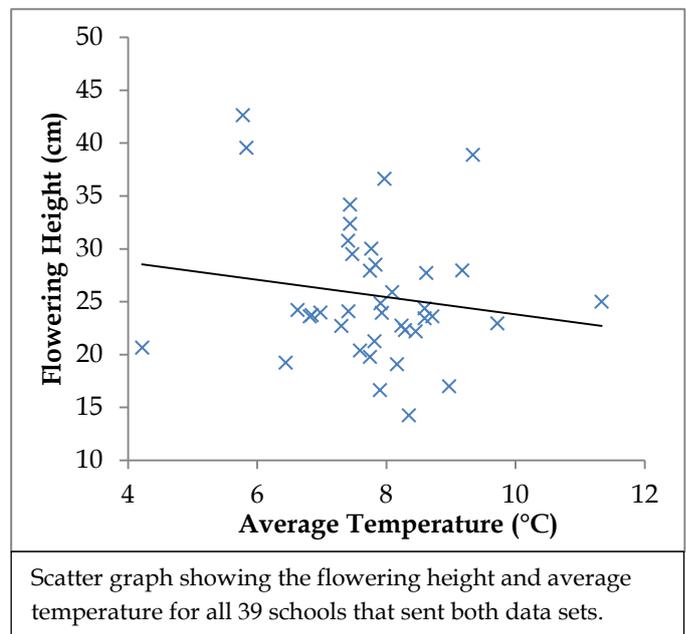
Chart 6: Average temperature vs Average flowering height in each area.



Source Information: As above, the average flowering date is from bulbs in the ground and in pots, and the temperature is taken from all of the schools that sent in their weather recordings.

There was a surprising negative correlation between flowering height and average temperature this year, meaning that **areas with lower temperatures recorded taller daffodils**. Although a statistical test showed that this correlation was not significant for the amount of data analysed.

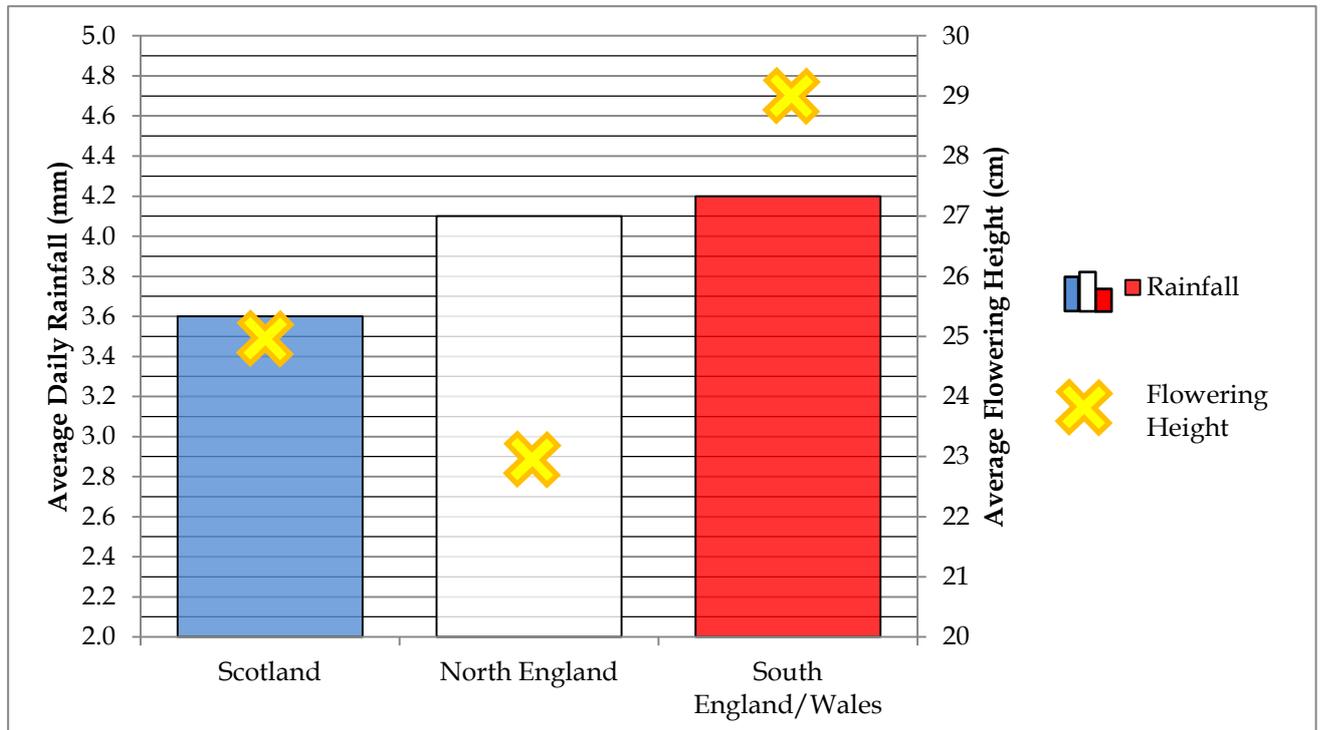
As explained in Hypothesis 1, temperature is difficult to analyse because it can be affected by the position of the thermometer (in the sun or shade) and the time of day temperature is measured. By averaging the data this effect should be lessened. The Met Office reported that December 2016 temperatures were unusually mild, particularly in the north of England and Scotland². This could have affected when the daffodil bulbs were triggered to start growing, as temperature is one of the factors that triggers bulbs to grow and for the daffodils to flower.



² <http://www.metoffice.gov.uk/climate/uk/summaries/2016/december>

Hypothesis 5: Schools in the area with the highest level of rainfall will record taller daffodil flowering heights.

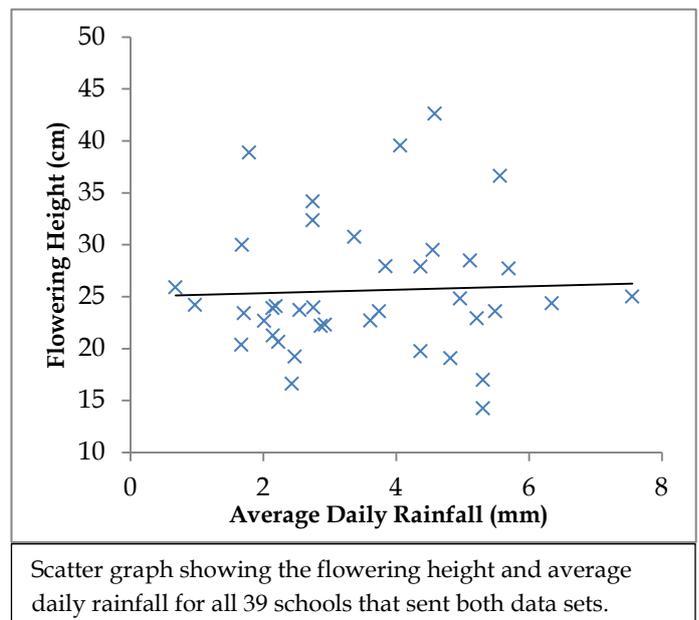
Chart 7: Average Daily Rainfall vs Average Daffodil Height in each area.



Source Information: The average flowering height includes results from the 41 schools that reported the heights of their bulbs in the ground. The amount of rainfall is taken from all the schools that sent in weather recordings.

This year schools in South England/Wales recorded the most rainfall, and they also recorded the tallest flowering daffodils. However North England recorded only 0.1mm less rain and had the shortest daffodils (on average 6cm shorter than South England/Wales).

Looking in more detail per school, it is difficult to see a correlation between flowering height and rainfall. A statistical test revealed there was an insignificant correlation between the two data sets, so **overall we cannot say that the data supports our hypothesis this year.** We will continue to investigate in following years in order to collect more data.



Summary

Well done to all of the schools that sent data for the Bulb Project this year! Your input has been invaluable in looking at our hypotheses. Even if you did not manage to get data to us this year we hope that this project has been fun and useful for teaching various curriculum topics. We have a survey online where we would love to get your feedback:

<https://www.surveymonkey.co.uk/r/EdinaBulbs2017>

Now that we have looked at the various effects the weather has on the daffodils, it has made us a lot more aware of its effects on our surroundings. Thank you once again for taking part!