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## Letter: Bumper summer for wine and climate in the UK

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## Bumper summer for wine and climate in the UK

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Dear Sir, Madam

**Bumper summer for wine and climate in the UK**

When Eglantine Vineyard (52°50' N), south Nottinghamshire, UK was planted in 1979 and began production in 1984, it was the most northerly commercial winery in the world. In 1986, six bottles of their wine were dispatched via Gatwick airport to be served as a novelty drink at the Second Cold Climate Conference in New Zealand. Afterwards, the German embassy telephoned to confirm reports that a vineyard near Berlin (52°31' N) had been supplanted as most northerly.

The latitude of Eglantine is remarkably close to the northern limit (53°N) shown by Hubert Lamb's (1982) iconic map of vineyards in Medieval England. Even Roman vineyards only reached as far north as Wollaston in the Nene Valley of Northamptonshire (52°15'N) and by the 1350s English wine production had fallen into decline (Hyams, 1953).

Most northerly status is now enjoyed by the Lerkekåsa Vineyard (59°24' N), Norway which was planted 30 years after Eglantine (Keegan, 2015). The poleward expansion in production of wine grapes is widely regarded as an indicator of global warming (Mozell and Thatch, 2014) as well as advancing techniques in viticulture. This is because climate combines with grape variety and soil type to create the 'trinity' of conditions for fine wines.

Despite their sensitivity to climate variability, surprisingly few UK vineyards have site specific weather data (Nesbitt et al., 2016). Here we evaluate one such rare record – the unbroken air temperature series at Eglantine which charts dramatic changes in grape growing conditions experienced in the East Midlands, UK since the 1980s.

The 1.8 Ha vineyard sits 75-85 m above sea level on a south-south east-facing carboniferous Limestone outcrop, overlain by glacial drift. Daily maximum and minimum air temperatures are recorded on site using mercury thermometers housed in a Stevenson screen. To plan harvesting and production, temperature data are converted into growing degree days (GDDs) – defined here as the cumulative sum of temperatures above 8°C (base8) or 10°C (base10) between 1 April and 31 October. For example, a mean daily temperature of 15°C gives 7 and 5 GDDs in base8 and base10 respectively.

Grapes develop through predictable stages as heat builds up. The Madeleine X Angevine 7672 grape variety at Eglantine breaks bud at ~25 GDDs, flowers at ~250 GDDs and ripens from ~800 GDDs (base10). Dates of harvesting vary from year to year depending on the pace of accumulated heat and resulting sugar-acidity balance of the grapes. This means that the best time for picking can be several weeks earlier after a hot summer compared with a cold growing season. The size of the harvest is also greater following hot, dry summers. Traditional red wine varieties generally need more heat than white wines to produce.

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3 In March 2018, a calibrated *Tinytag Transit 2* thermistor was installed alongside the  
4 thermometers to shadow manual measurements and thereby corroborate the long-  
5 term series for Eglantine. The Tinytag was set to log temperatures every hour.  
6 Based on a comparison between the manual and automatic measurements during  
7 2018, we determined that observer bias in the GDD was less than 4%.  
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10 Little did we know that we would be measuring first the ‘Beast from the East’ and  
11 then the hottest summer on record in England (Met Office, 2018). Extreme  
12 temperatures at the vineyard ranged between  $-2.8^{\circ}\text{C}$  (18 March 2018) and  $31.9^{\circ}\text{C}$   
13 (26 July 2018) (Figure 1a). An unusual spring heatwave was also observed with a  
14 peak temperature of  $27.2^{\circ}\text{C}$  on 19 April 2018.  
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18 Another remarkable aspect of summer 2018 was the number of accumulated GDDs  
19 (Figure 1b). The summer set a record of 1106 GDDs (base10) and strengthened a  
20 statistically significant ( $p<0.01$ ) trend since the 1980s (Figure 1c). Only three other  
21 growing seasons in the series have exceeded 1000 GDDs. These were in 2006  
22 (1053), 1995 (1010) and 2011 (1003).  
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25 Over the last 39 years, GDDs (base10) have risen by on average 60 days per  
26 decade. Whereas harvest time was typically around 25 October in the 1980s, it is  
27 now most likely to be at the end of September. Higher temperatures also mean that  
28 the optimal sugar-acidity balance is more likely to be achieved. This reflects a  
29 country-wide trend of improving quality, especially for English Champagne style  
30 wines which regularly win international awards (e.g. Sommelier Wine Awards, 2018).  
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34 The warming observed at Eglantine fits with a national picture of rising temperatures.  
35 Nine out of the ten warmest years in the UK have occurred since 2002; the most  
36 recent decade of analysis (2008-2017) had 15% fewer days of air frost than in 1961-  
37 1990; and the average number of GDDs (base5.5) each year has increased by 14%  
38 over the same period (Kendon et al., 2018).  
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41 Historic trends and expected changes in climate point to a bright future for UK wine  
42 producers – if smart choices are made about cultivars (Nesbitt et al., 2016). Some  
43 speculate that geological and climate conditions may eventually favour viticulture in  
44 the Great Glen of Scotland (Selley, 2008). Wine is already being produced from  
45 vines grown in North Yorkshire ( $54^{\circ}12' \text{ N}$ ) and in Lusk, County Dublin ( $53^{\circ}32' \text{ N}$ ).  
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49 Although Eglantine vineyard is today far south of the European wine-producing  
50 frontier, on site adaptations are being made to the changing conditions. For example,  
51 later ripening grape varieties (Chardonnay, Pinot Meunier and Pinot Noir) are now  
52 grown, bringing new commercial opportunities and prestige. Sparkling wines have  
53 been produced on site every year since 2006. Earlier harvesting is accommodated  
54 by a dedicated and flexible workforce. Labour intensive methods of leaf-stripping are  
55 used to manage new pests, such as the Japanese Fruit Fly (*Drosophila suzukii*)  
56 which first appeared in 2016. The local wood pigeon population has also recently  
57 acquired a taste for grape buds.  
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Despite such challenges, the sunny hillslopes of Nottinghamshire have become suitable for sparkling wine and, thanks to the extraordinary summer of 2018, English vineyards continue to enjoy a bumper time. Cheers to that!

**Robert L. Wilby**, Loughborough University, UK

**Tony and Veronica Skuriat**, Eglantine Vineyard, UK

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**Figure 1** (a) Daily minimum and maximum air temperatures March to December 2018, (b) daily growing degree days April to October 2018, and (c) annual growing degree days (base10) recorded at Eglantine vineyard, Nottinghamshire, UK

