



UK Research
and Innovation



Characterising and adapting to climate risks in the UK wine sector

www.lse.ac.uk/granthaminstitute/resilient-wine/



VINESCAPES
— VINEYARD & WINERY CONSULTANTS —



21st October. UK Climate Resilience Webinar

Prof. Steve Dorling, Dr Alistair Nesbitt,

Prof. Declan Conway, Dr Kate Gannon, Frances Trappey

An introduction to the team



Dr. Alistair Nesbitt



Dr. Kate Gannon



Prof. Steve Dorling



Prof. Declan Conway



Climate resilience in the UK wine sector — CREWS-UK

As cool climate viticulture expands rapidly in the UK, this new research project will improve information on how climate change will affect the wine production sector, to inform better decision-making and investment.

Climate change and UK wine production

The UK's burgeoning wine production sector – located in England and Wales – is winning international acclaim and awards, particularly for its sparkling wines, and is attracting significant investment interest. Supported by warming climate trends during the growing season, wine producers are opening new vineyards planted with grape varieties that are popular with consumers.

Grape-friendly weather conditions in 2018 led to a record harvest and may be a sign of good things to come as the overall warming trend seems likely to benefit some

aspects of grape-growing in the UK. However, weather and growing season conditions fluctuate from year to year, meaning that yields and grape quality vary significantly. Climate change is likely to cause more extremes, further threatening the stability of production. Current uncertainty over future climatic conditions during the growing season and their potential effects on viticulture in the UK exposes both existing producers and potential investors to an unquantified risk.

A research collaboration to improve information to the sector

There is an urgent need for more and better information about climate change that wine producers and investors can use for decision-making. Climatologists, wine sector specialists and social scientists from the Grantham Research Institute on Climate Change and the Environment and the University of East Anglia are collaborating in the CREWS-UK project to fill this gap.

“By integrating new bespoke climate scenarios with increased understanding of adaptive behaviour in the UK wine sector, the CREWS-UK project aims to translate model results into more user-relevant information, contextualised to suit the detailed needs of different stakeholders”

Denbies vineyard, Dorking, Surrey



Project objectives and overview

Fast growing sector

Highly sensitive to climate

Warming brings opportunity and risk

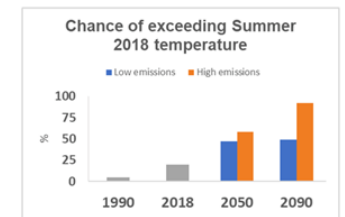
Research opportunity:

- New projections
- Adaptation in an emergent private sector
- Long-lived decisions
- Bumper harvest in 2018

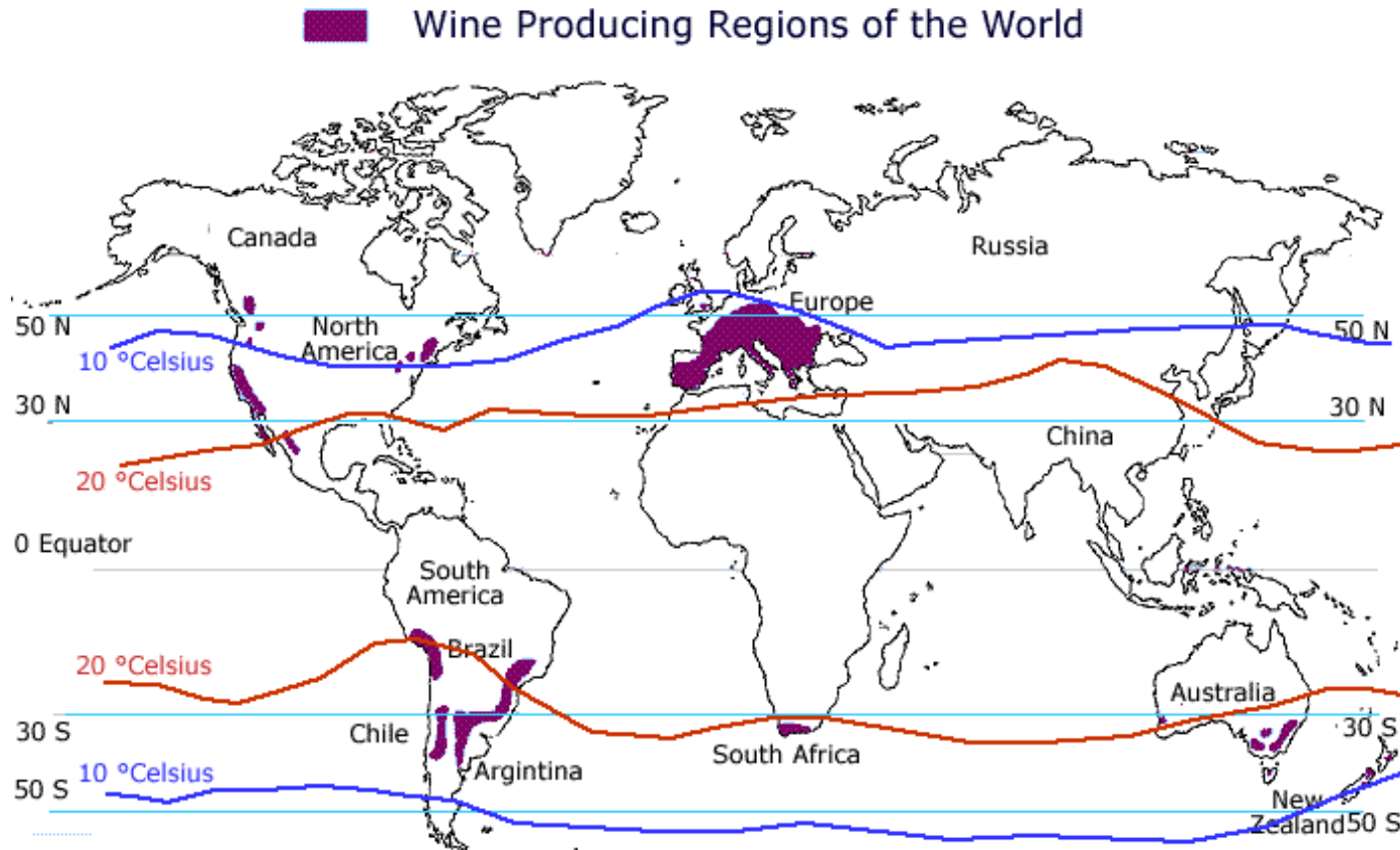


Summer 2018 heatwave

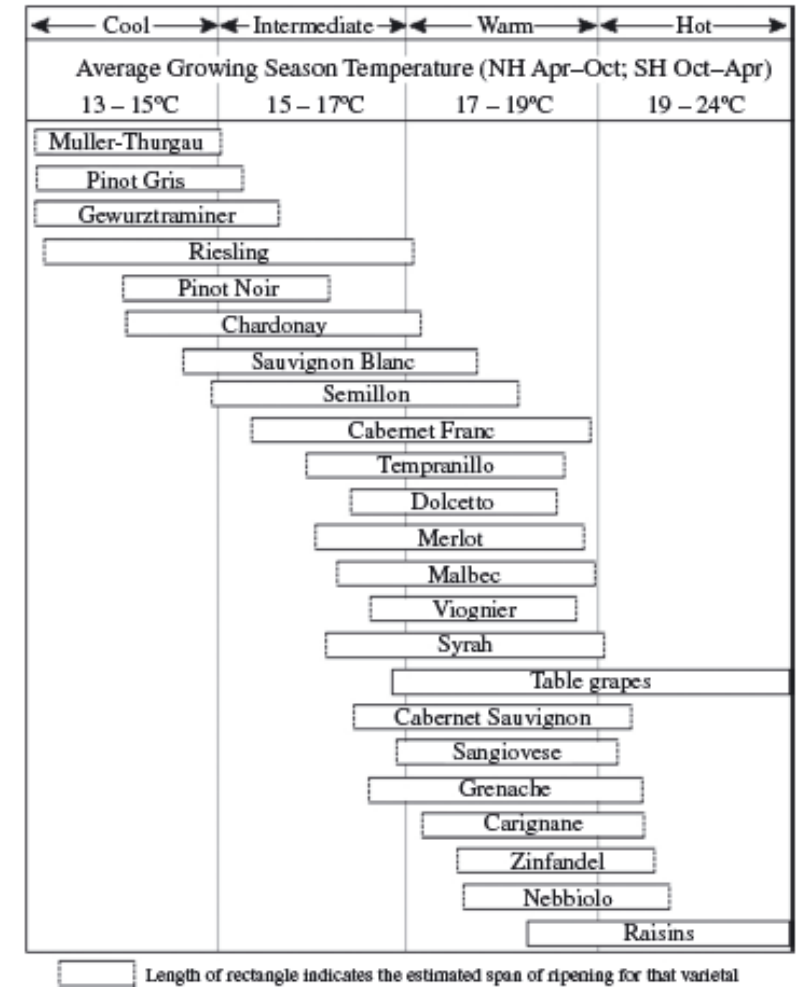
- Chance of such hot summers low in the baseline period (<10%)
- By mid-century the chance of hot summers will be of the order of 50%
- Beyond 2050 the chance of a warmer summer more strongly depends on emission scenario



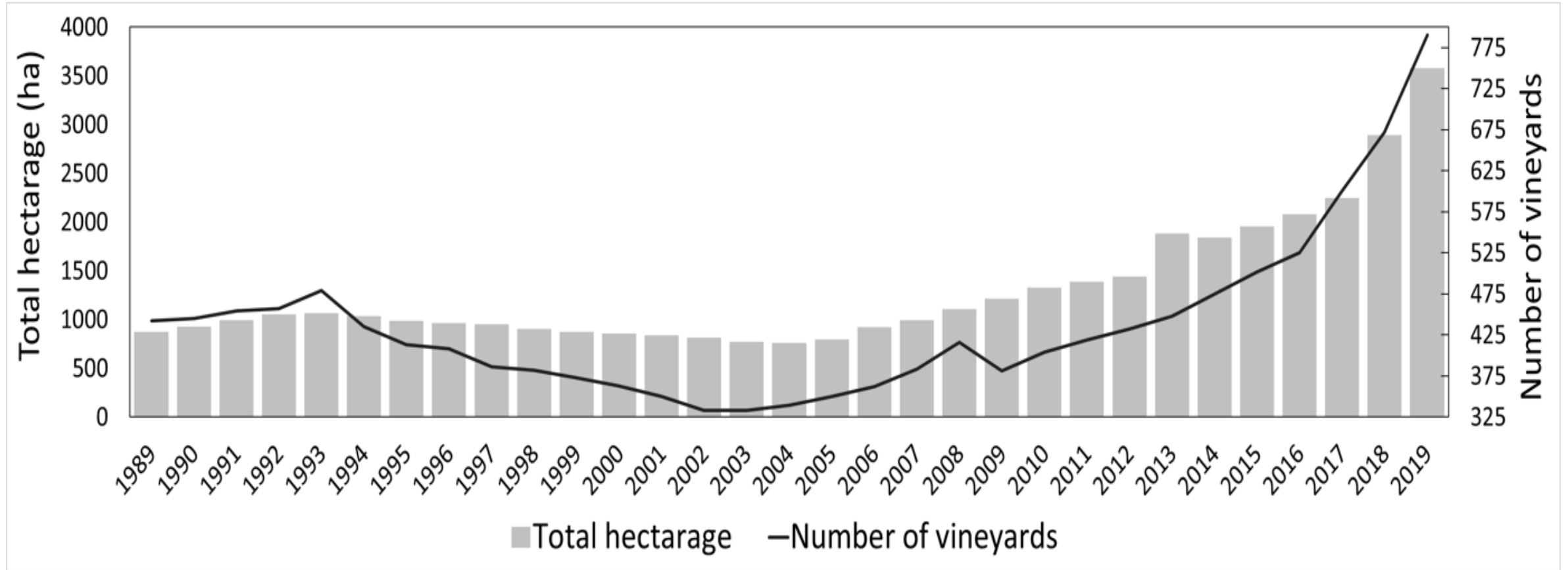
Climate suitable regions and variety groupings



Greg Jones, 2006



The Fall and Rise of the GB Wine Sector

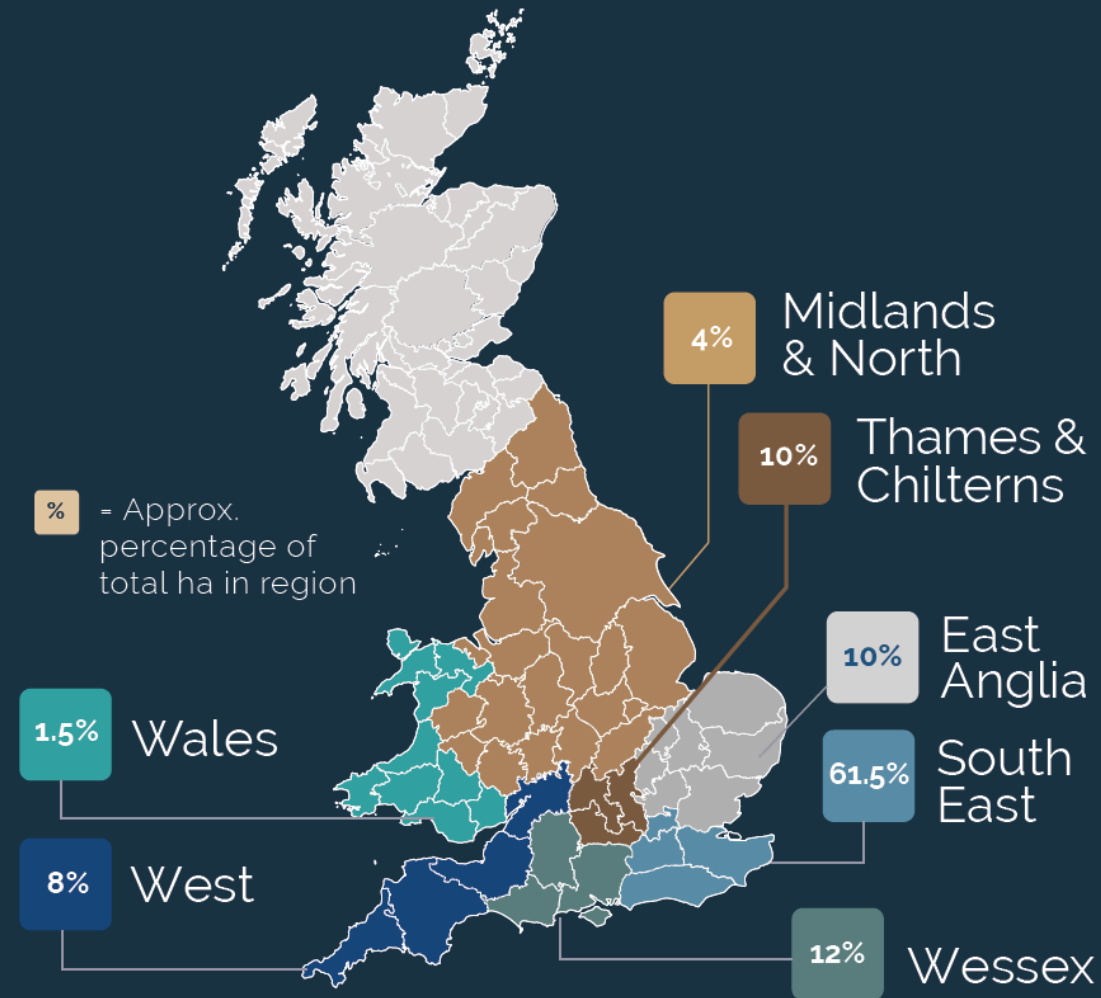
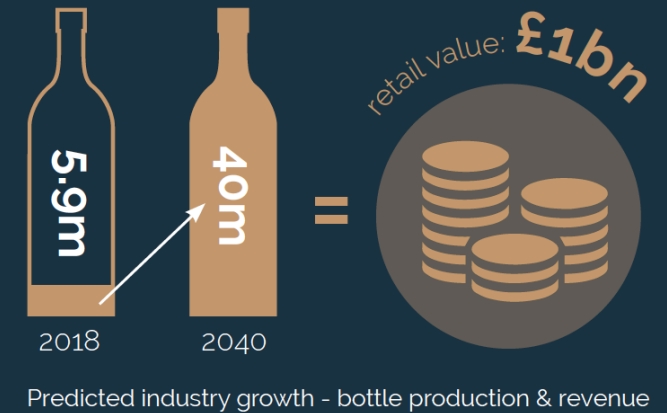


1. The wine regions of GB

UK sales: **40m bottles/£1bn by 2040** - trade survey

How big will the industry have expanded in 20 years? Looking around the world it is possible to see how other New World regions have grown in relation to the time when they were approximately the same size as the current GB industry. For example, Oregon:

- Very similar in structure to GB with lots of small, family run operations with very few big players involved.
- In 1992, Oregon had 5,950 acres of planted vines and was producing 5.2m bottles, compared with 6,200 acres and a production 5.9m bottles from WineGB's survey.
- 23 years on to 2015 and Oregon was selling 37.1m bottles.
- Assuming growth in our domestic market might follow a similar trend, then it would not be difficult to see how the UK's industry could easily be selling 40m bottles by 2040 with a retail value of perhaps £1bn or more.



Average Growing Degree Days

Area	1961-1990 average	1981-2010 average	2009-2018 average	2018
UK	1472	1610	1695	1807
England	1677	1841	1946	2088
Wales	1520	1663	1741	1857
Scotland	1128	1225	1282	1356
Northern Ireland	1426	1552	1617	1668

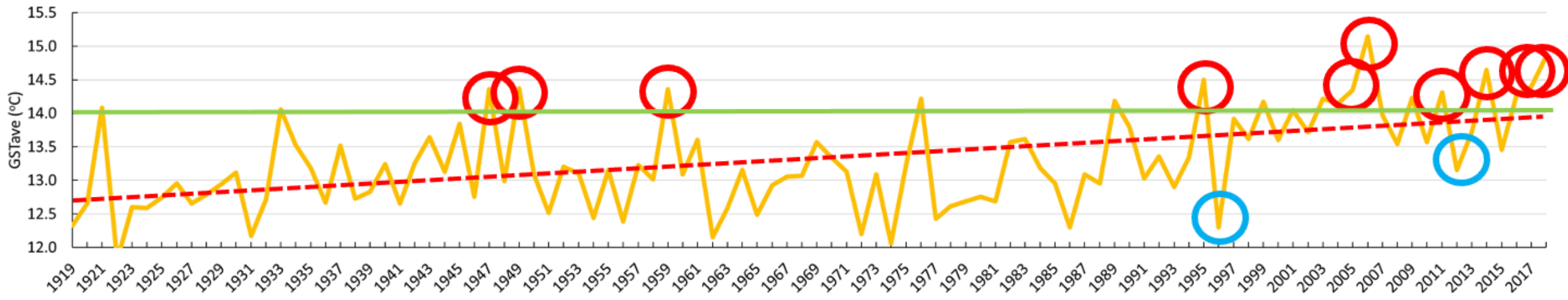
A changing viticulture climate

- Average Growing Season Temperature

Impact of recent climate change and weather variability on the viability of UK viticulture – combining weather and climate records with producers' perspectives

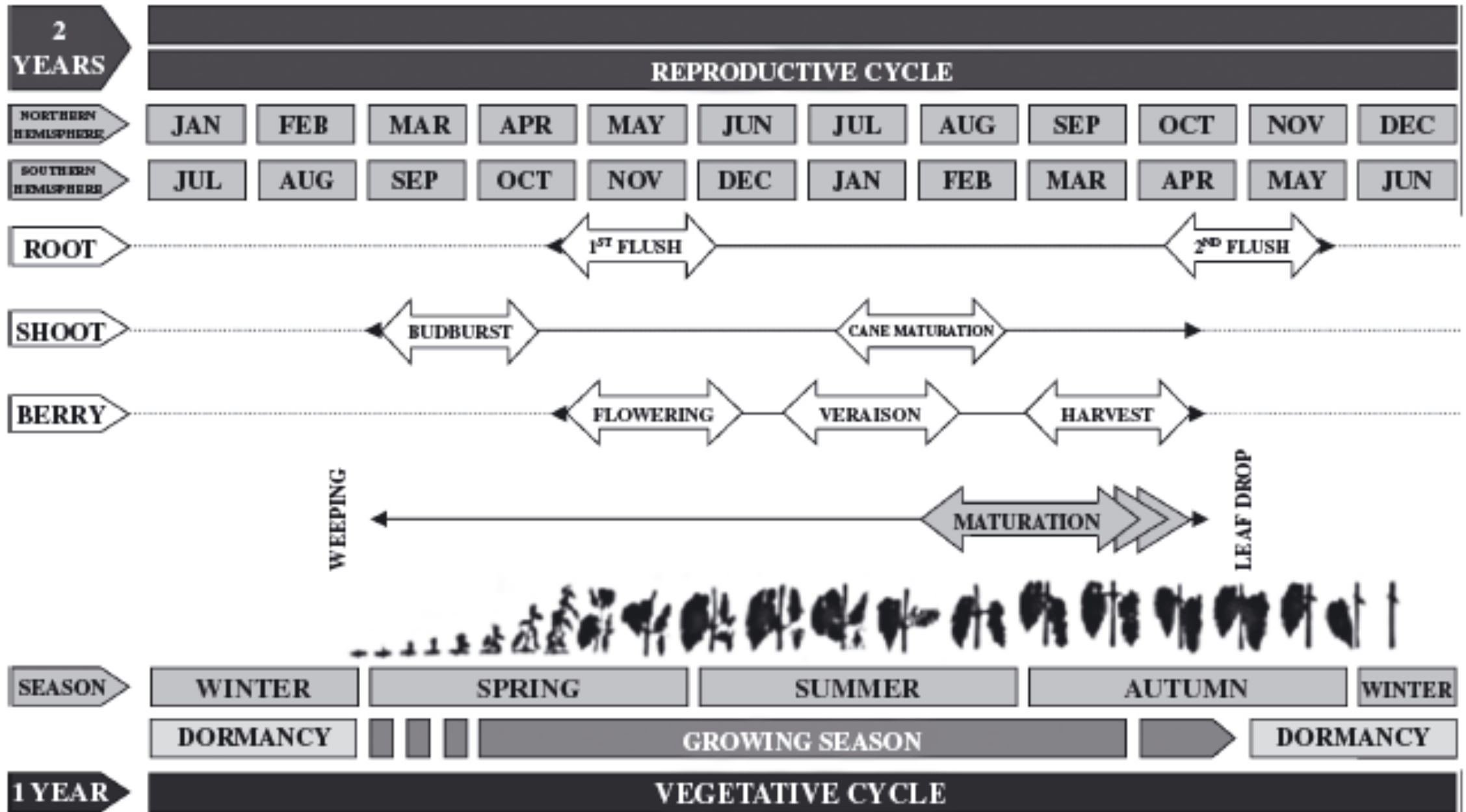
NESBITT, B. KEMP, C. STEELE, A. LOVETT and S. DORLING
Australian Journal of Grape and Wine Research. 2016

SE & SC England GSTave 1919 - 2018 (100-years)

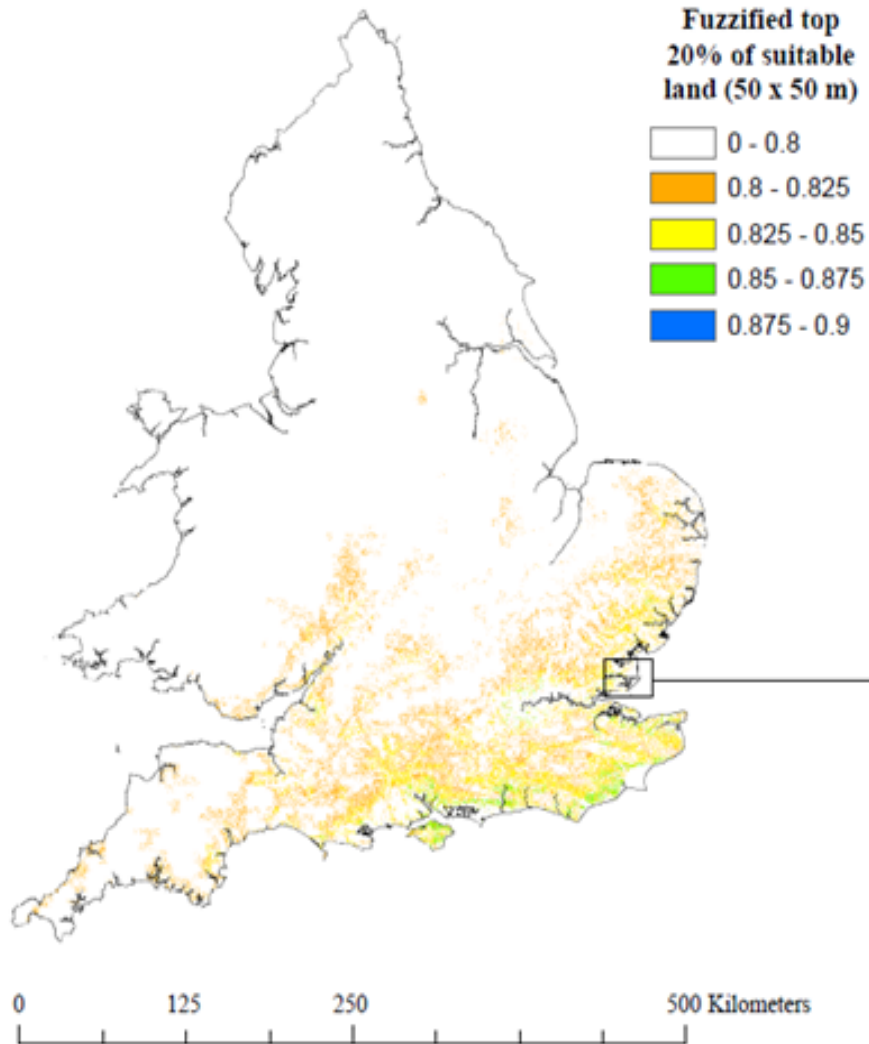


6 of the top 10 warmest growing seasons (April-October) in the last 100 years have been since 2005: 1947, 1949, 1959, 1995, 2005, 2006, 2011, 2014, 2017 and 2018 (Met Office, 2018)

Grapevine Phenology



Viticulture Suitability



JOURNAL OF LAND USE SCIENCE
2018, VOL. 13, NO. 4, 414-438
<https://doi.org/10.1080/1747423X.2018.1537312>



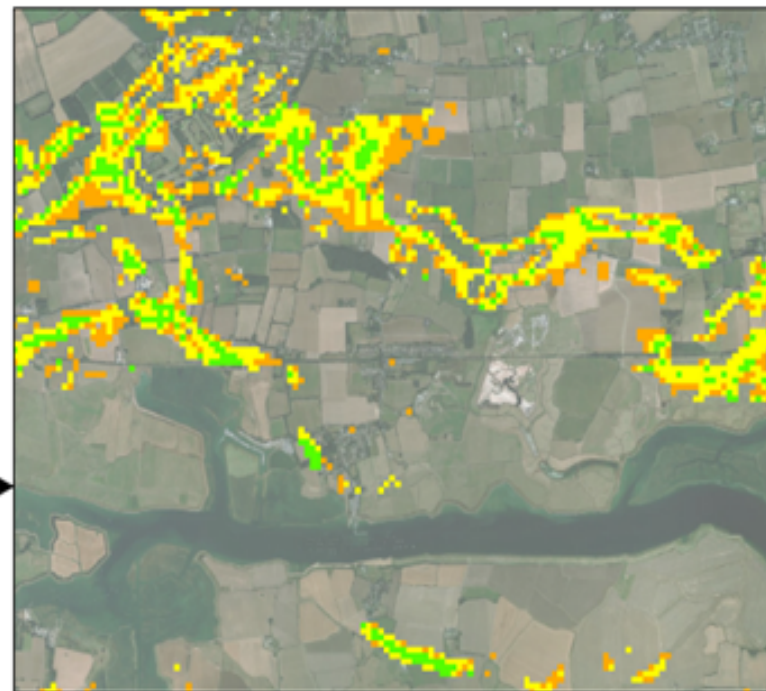
ARTICLE

OPEN ACCESS

A suitability model for viticulture in England and Wales: opportunities for investment, sector growth and increased climate resilience

A. Nesbitt^a, S. Dorling^b and A. Lovett^b

^aClimate Wine Consulting Ltd, Surrey, UK; ^bSchool of Environmental Sciences, University of East Anglia, Norwich, UK



Vineyard owner's dismay as grape crop ravaged by late frosts

Chris Hill chris.hill@archant.co.uk [@ChrisHill75](#)

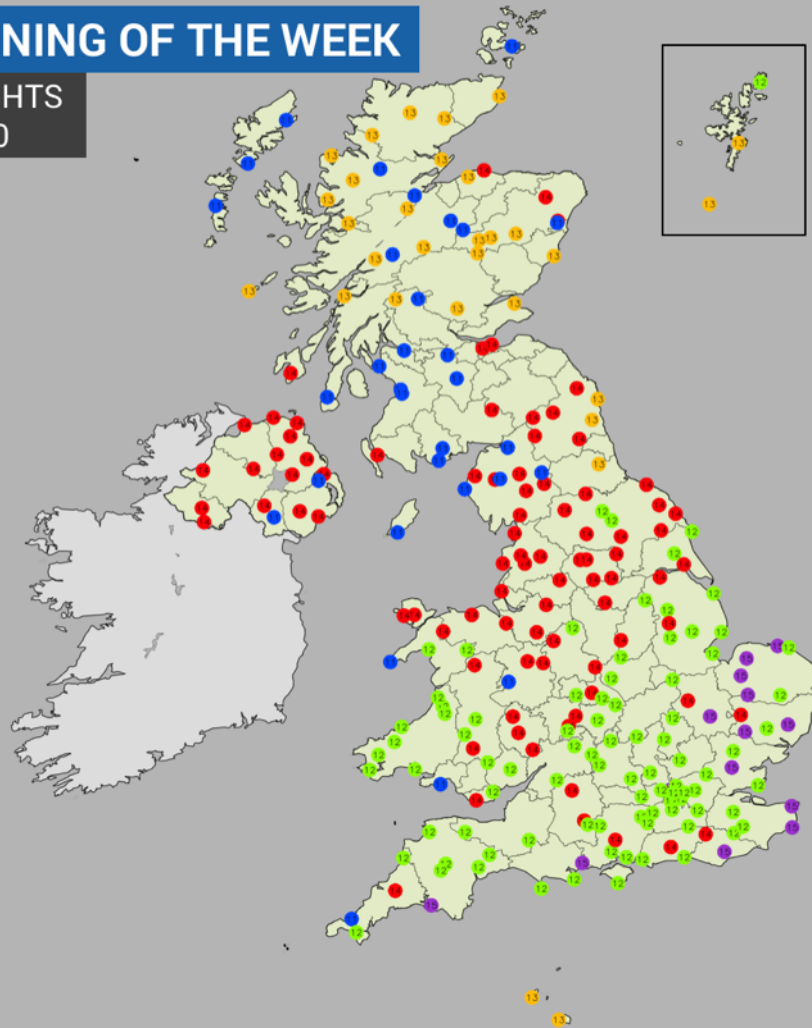
PUBLISHED: 18:26 18 May 2020 | **UPDATED:** 18:26 18 May 2020



COLDEST MORNING OF THE WEEK

LOWEST OF ALL NIGHTS
11th – 15th MAY 2020

- 11 Monday
- 12 Tuesday
- 13 Wednesday
- 14 Thursday
- 15 Friday



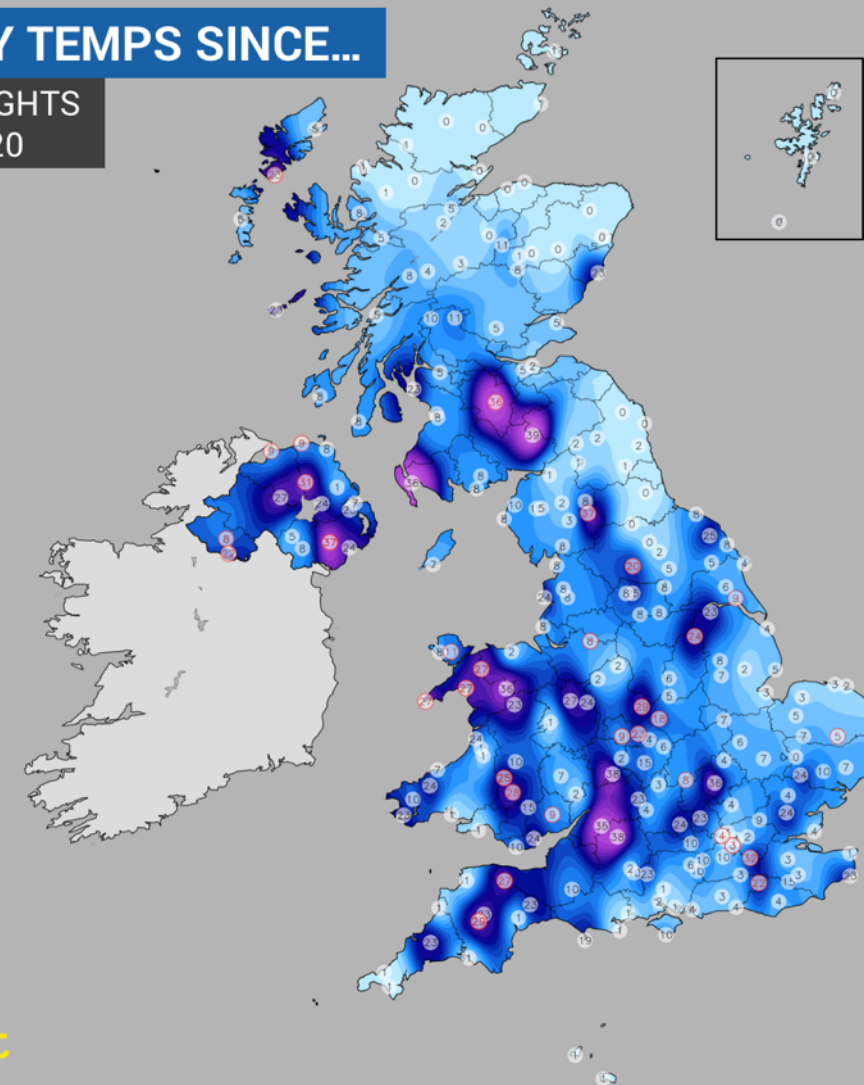
COLDEST MAY TEMPS SINCE...

LOWEST OF ALL NIGHTS
11th – 15th MAY 2020

Years



23 New station record



Grantham
Research Institute
on Climate Change
and the Environment



UK Research
and Innovation





UK Vineyard Frost Survey 2020

Powered by Mapman Ltd a WineGB Silver Patron



Frost Survey Results



#vinefrost @ Ridgeview Wine Estate;
© Julia Claxton

Filter the map and update the dashboard using the options below. Select 'None' to remove filters.

Vineyard

None

Date Range

None From : To

Submit your vineyard's Frost date(s) using the [online form](#). If you make a mistake please [contact us](#).



No. Frosts

❄️ **211**

Frost Timeline

100 Latest Records
Sort Order: Latest to Earliest

Four Oaks Vineyard
20/5/2020

● Min Temp: -3_°c
Protection: **no protection**
Damage: 90 - 100 %

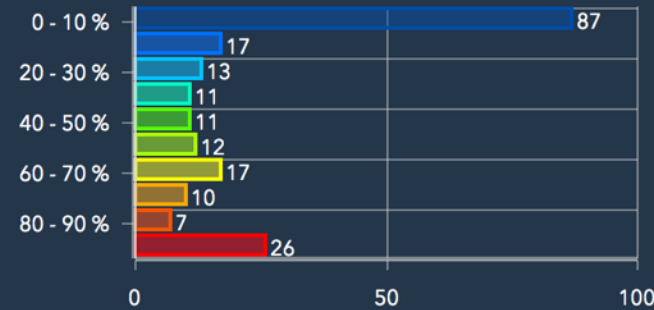
● Albury
15/5/2020
Min Temp: -2_°c
Protection: **bougies**
Damage: 0 - 10 %

● Kidmore Organic Vineyard
15/5/2020
Min Temp: -1_°c
Protection: **bougies,sprays**

◀ Frost ▶

% Frost Damage

Select a bar(s) to filter the map and update the dashboard. Click again to deselect.

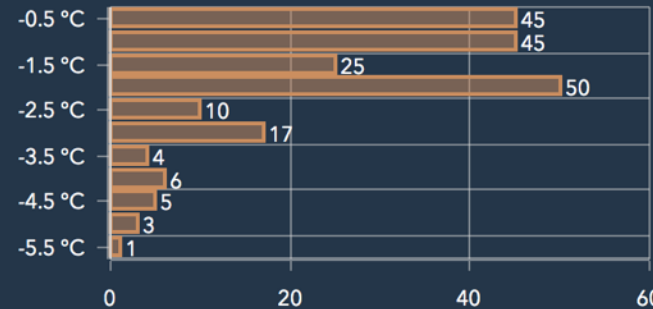


No. Records

◀ % Frost Damage Serial Chart ▶

Minimum Temperature

Select a bar(s) to filter the map and update the dashboard. Click again to deselect.



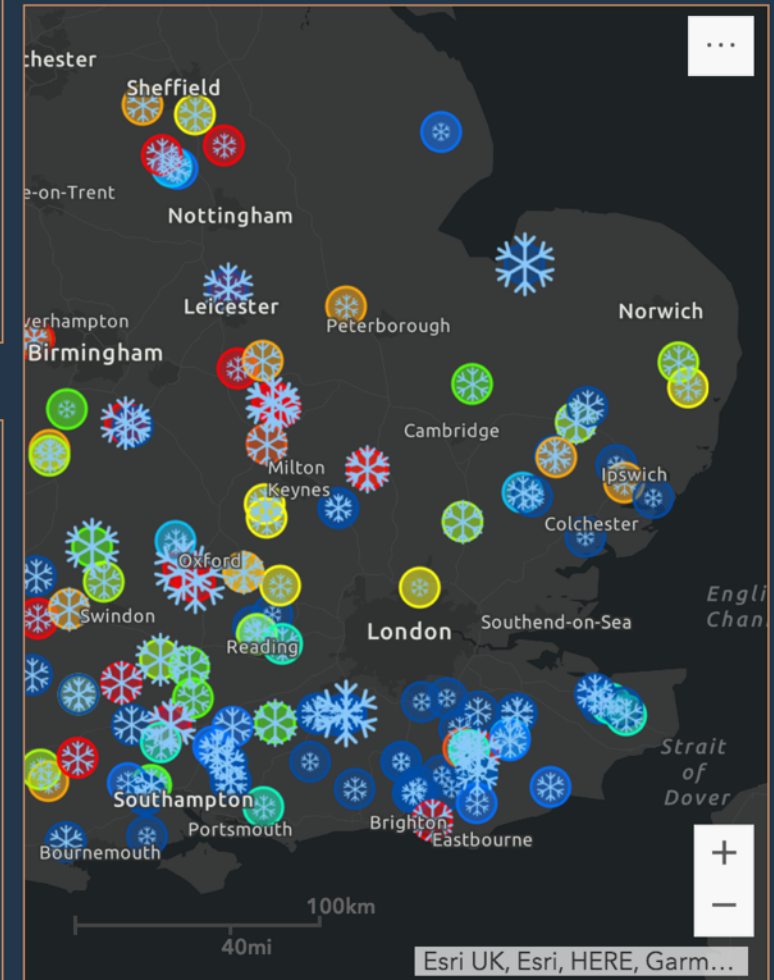
No. Records

◀ Minimum Temperature Serial Chart ▶

Sponsor



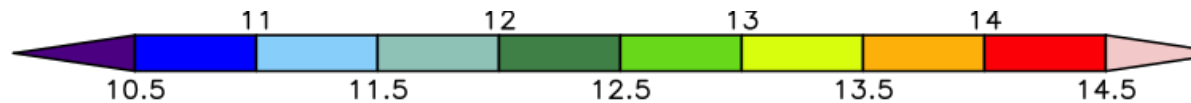
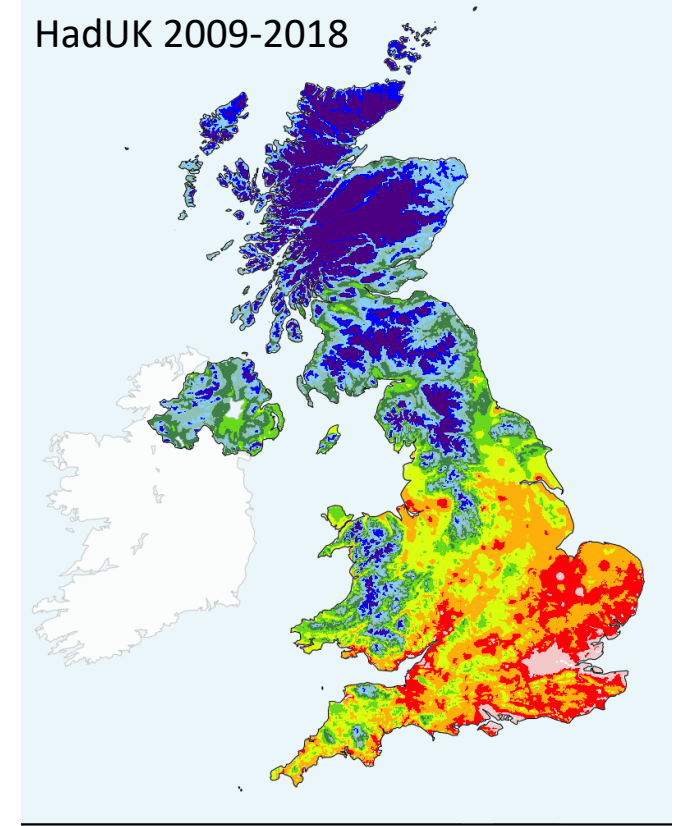
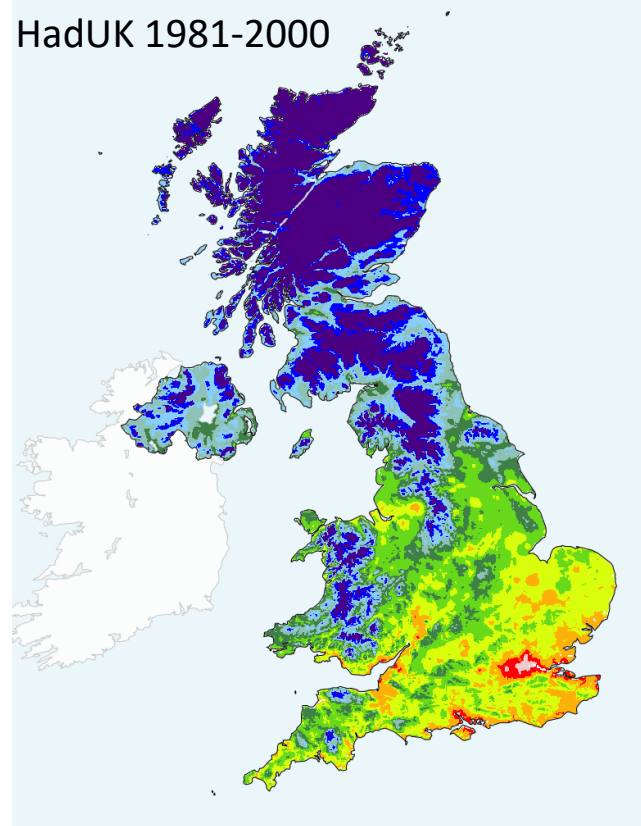
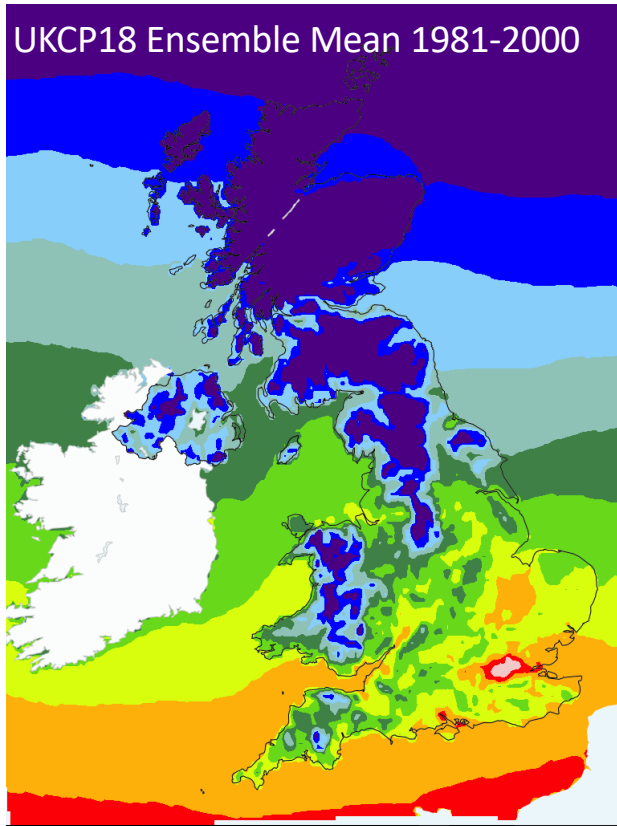
The UK Vineyard Surveys are sponsored by **Environment Systems**. We also support **Sustainable**



Esri UK, Esri, HERE, Garm...

© Mapman Ltd

UKCP18 and HadUK Growing Season Temperature



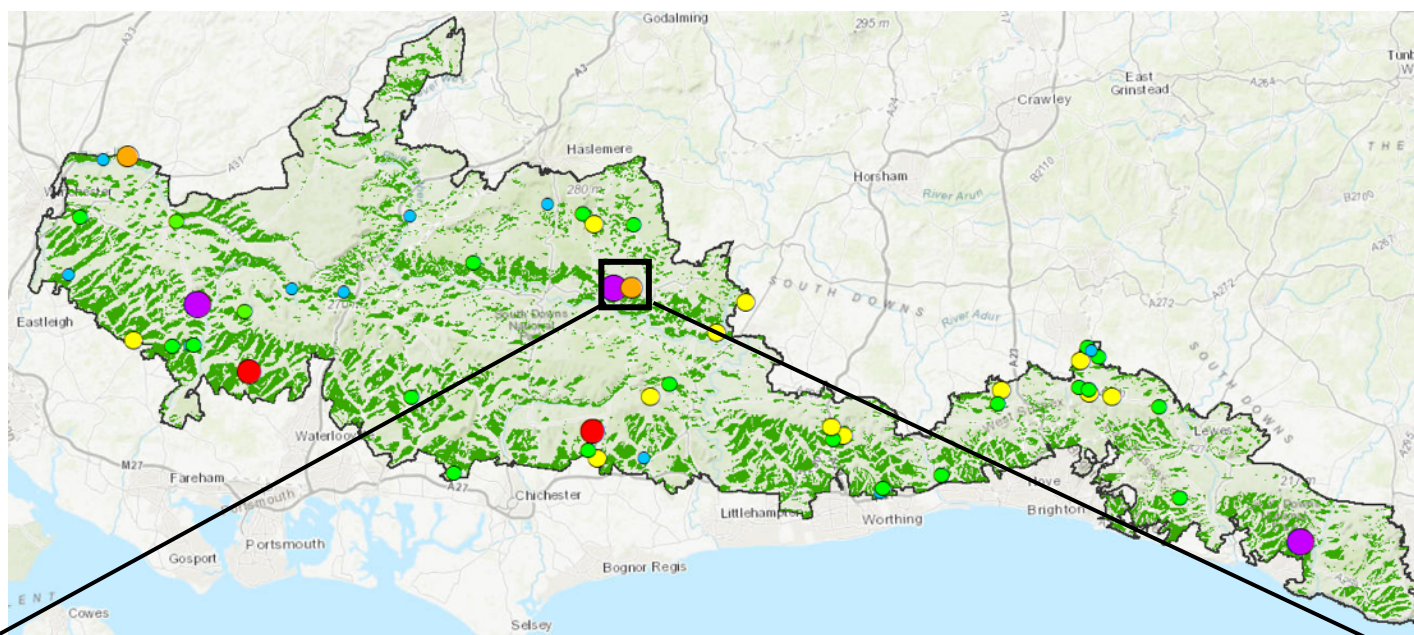
UKCP18

Ensemble

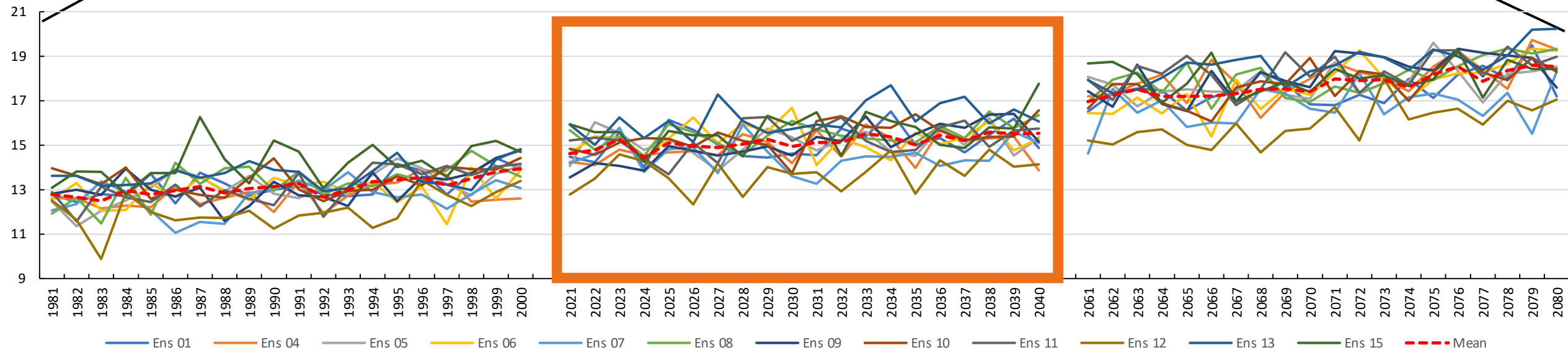
1981-2000

2021-2040

2061-2080



UKCP18 12 model member and mean GST climate projection for 1981-2000, 2021-2040 and 2061-2080 for a single 5x5 km gridcell



Shifting viticultural suitability windows and opportunities and challenges for global viticulture

- Viticultural suitability windows - the geographical range in which different grape varieties can be successfully grown and ripened - are shifting rapidly.
- Renowned wine regions are regularly exceeding optimum GST for the grape varieties that they are known for.
- Adaptation is taking place at vineyard and winemaking levels of production
- But lock-in is limiting adaptation in some areas
- The UK is an emergent and understudied landscape

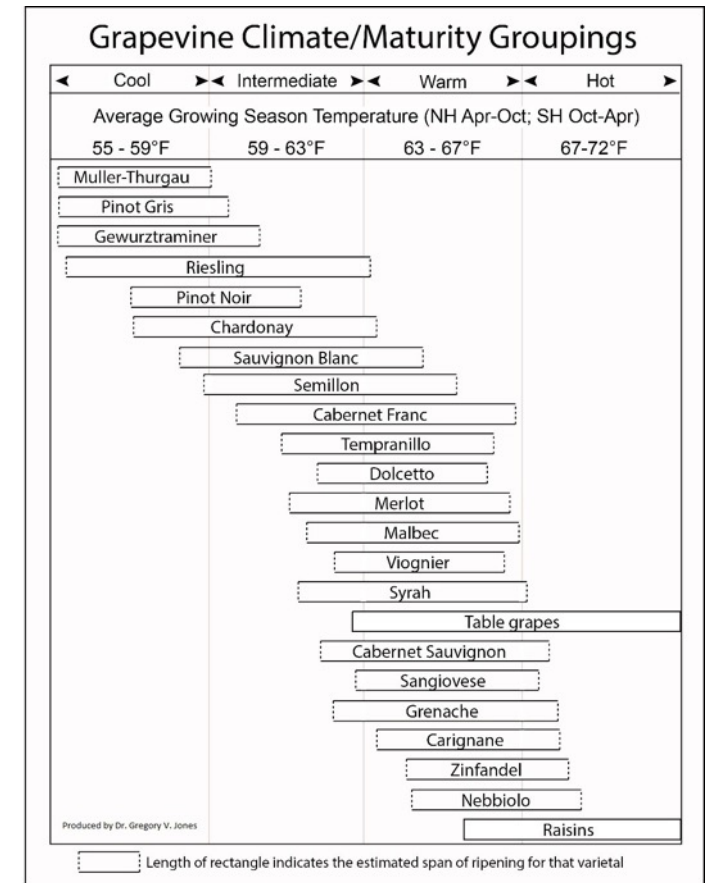
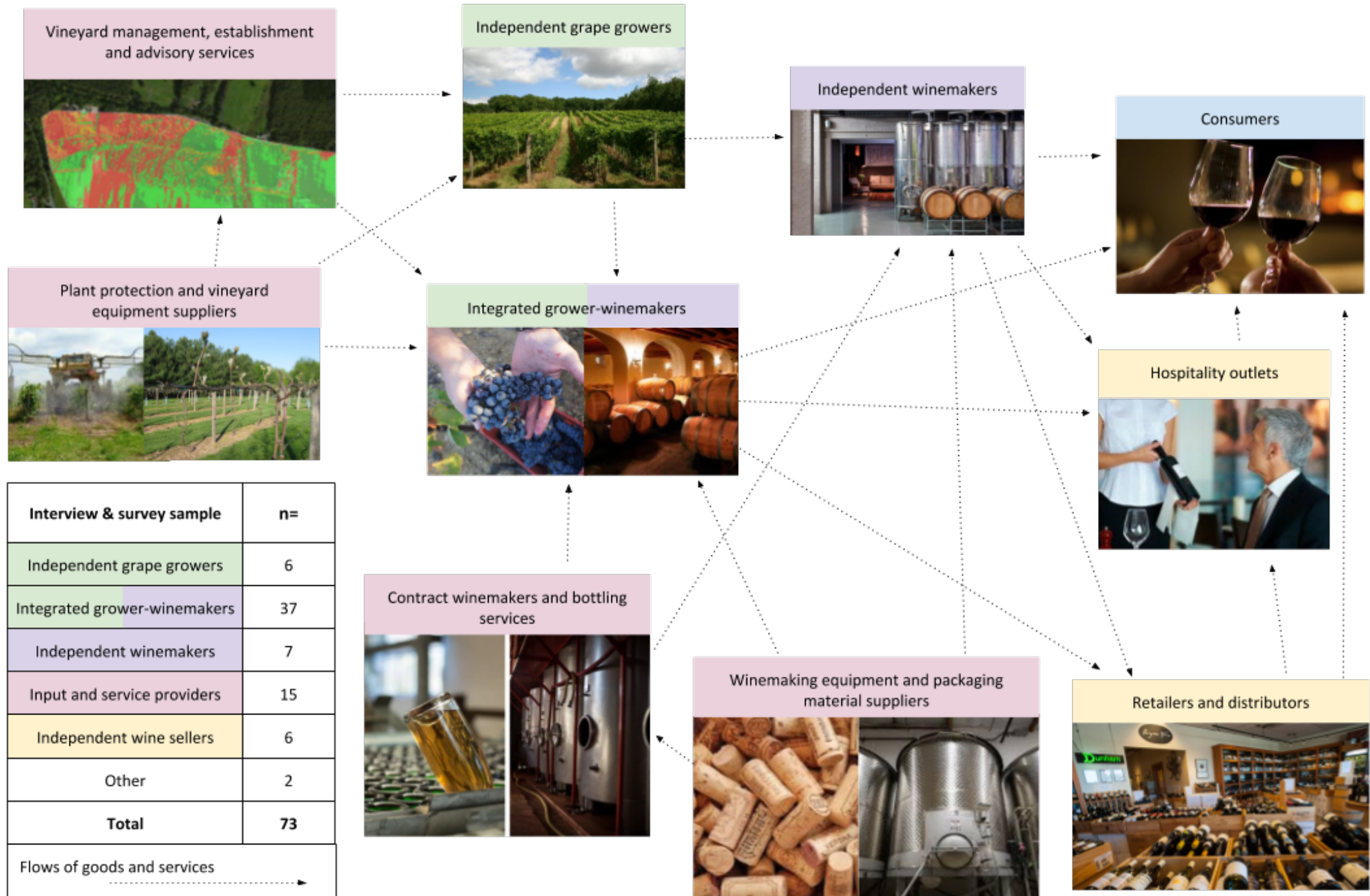


Figure by Dr Gregory Jones

Climate change adaptation in the UK Wine Sector: Research Questions

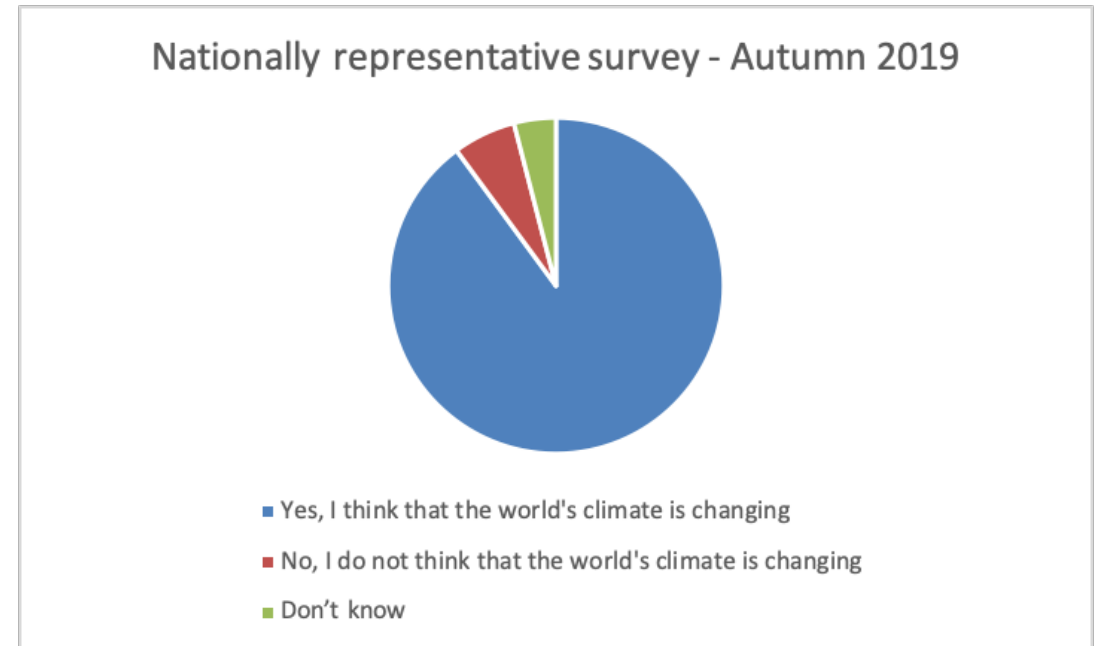
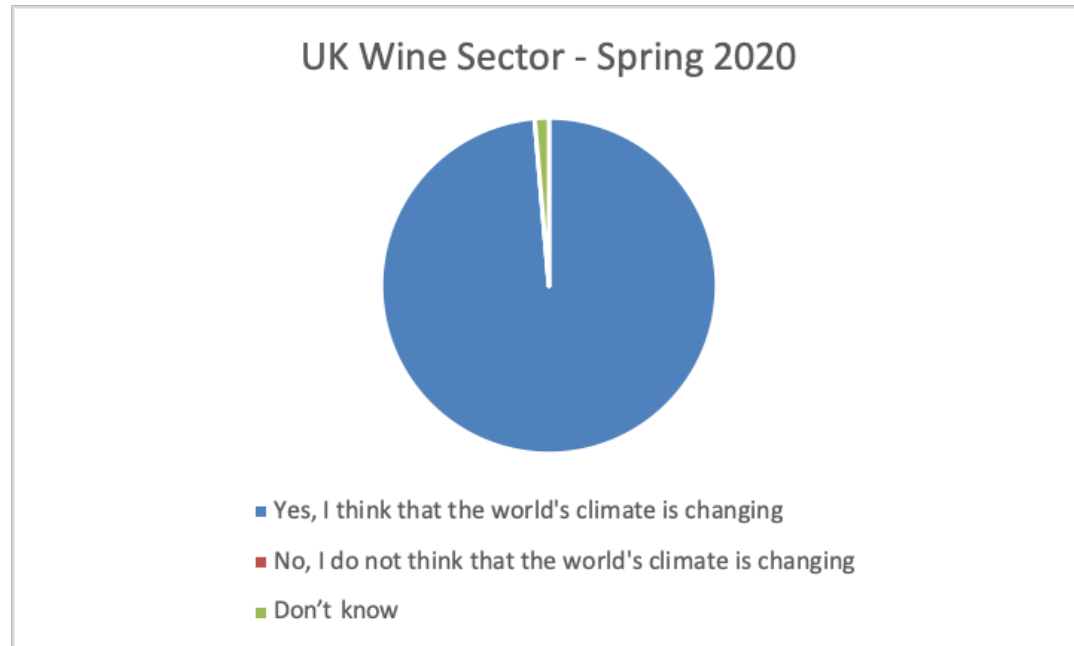
- How is the UK wine sector accounting for climate change in its development?
- How do producers manage climate risks and opportunities in cool climate viticulture?
 - How do climate variability and one-off extreme climate events influence adaptation decisions, within the context of perceptions of long-term climate change trends?
 - How does producer adaptation behaviour interact with the broader viticulture value chain?



Interview & survey sample	n=
Independent grape growers	6
Integrated grower-winemakers	37
Independent winemakers	7
Input and service providers	15
Independent wine sellers	6
Other	2
Total	73

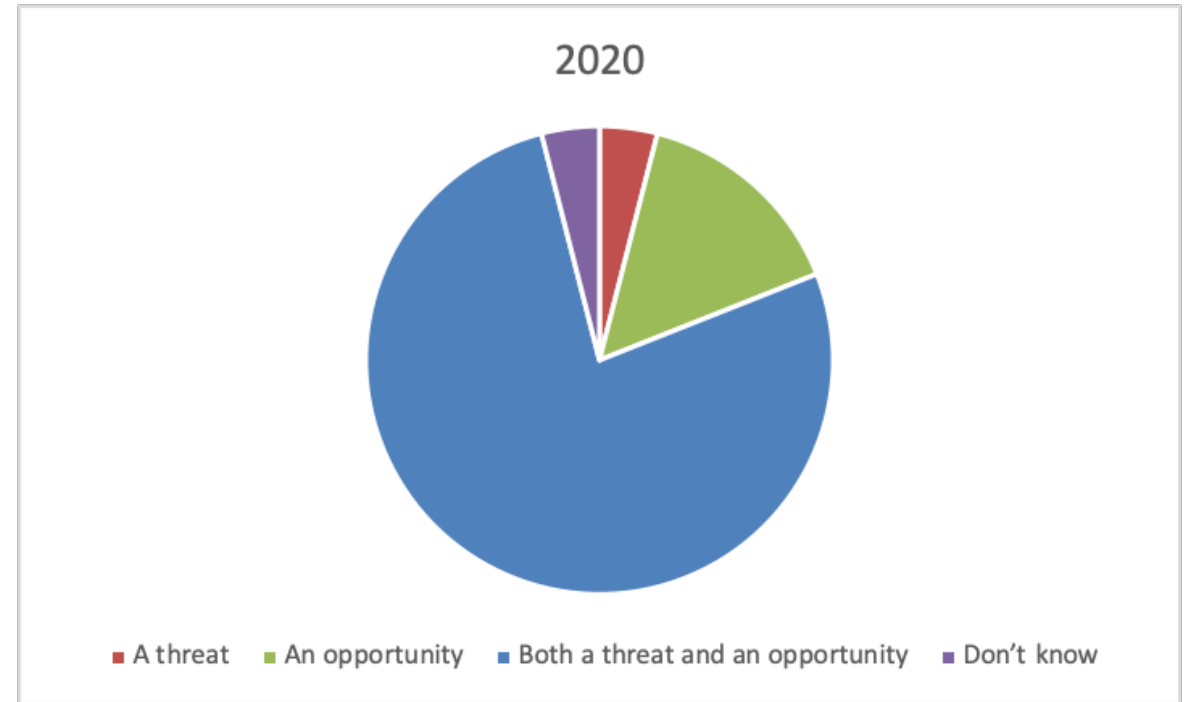
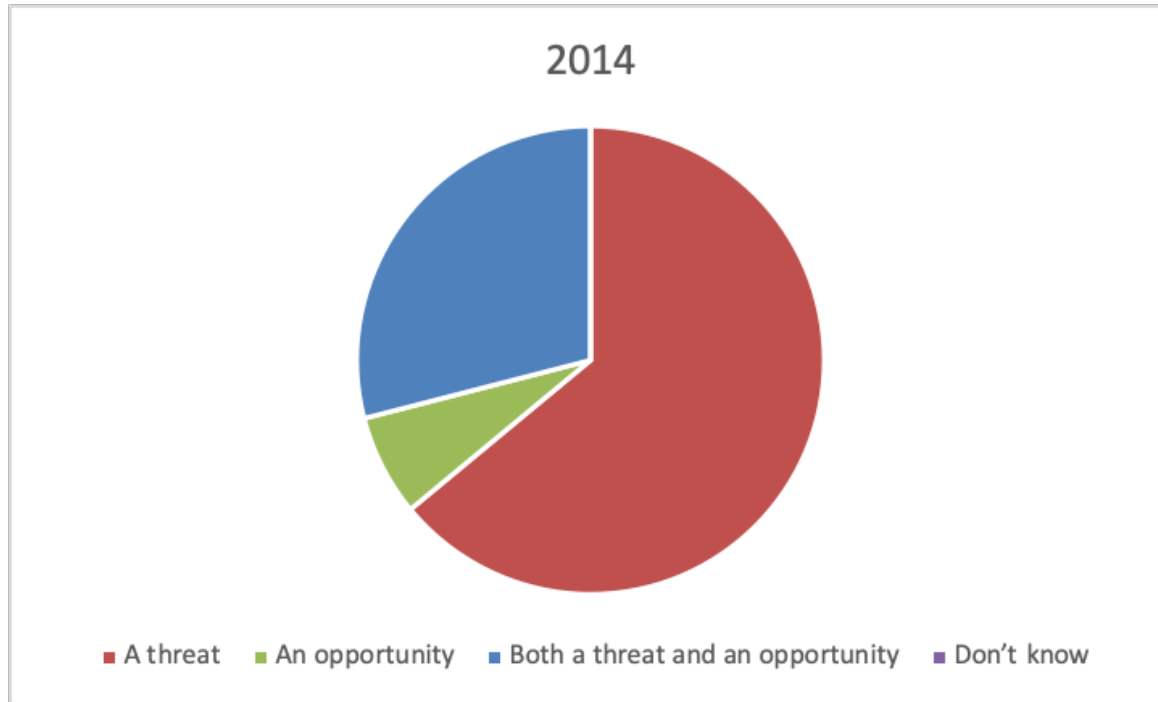
Flows of goods and services →

Do you think the world's climate is changing or not?



Steentjes, K. et al., (2020), *British public perceptions of climate risk, adaptation options and resilience (RESIL RISK): Toplevel findings of a GB survey conducted in October 2019.*, Cardiff University, Cardiff.

Shifting perceptions of climate risk



An opportunity

Ripen new grape varieties

"We can ripen grape varieties that we couldn't ripen 20 years ago"

Produce new types of wine

A response to the challenges being felt in other wine producing regions

"The Champagne region is being really harmed by global warming, and that is creating an opportunity for us here"

Climate change has given investors confidence

Harvest of 2018

"An almost perfect year"

A threat

Inter-annual variability in climatic suitability and weather conditions

"What we are finding is that one year we will have 30 degrees in April and the next year we will have snow in April. That makes it very difficult to manage viticulturally"

Varying yields and ripeness

More extreme events

Wetter conditions

Threat of heightened or novel disease or pest burden

Earlier budburst increasing risk of frost damage

Drought

Grape grower climate change preparedness and planning



Site selection

Site selection, site diversification and site relocation

- *"20 years ago, people would have probably come to us and said, we've got 50 acres or whatever at the back of our house and we're just planting... Now, we don't [source in this way]. We ask where are the absolute best places in the UK to grow grapes. And then we'll go after them"*

Use of new forms of (climate) information to identify ideal sites

Variety selection

Variety, clone and rootstock selection and diversification

- Selection of varieties that can be used for still or sparkling wine production: *"We wanted to plant varieties where we had a lot of options in a winemaking sense"*
- Early ripening varieties
- Pest/fungal resistant varieties

Diversity and experimentation, including to buffer for losses

- *"We chose a mix of varieties that we knew would ripen for us now, but also a couple of varieties that are almost a gamble on climate change"*
- *"We chose a range of grapes because then we would be able to harvest something good"*

Vineyard management and investments in equipment, labour and knowledge

Investment in frost protection and crop protection technologies

Production regimes to support resilience of soils/vines and/or to create unique marketable qualities (e.g. organic, biodynamic, Protected Designation of Origin - PDO or other sustainability or biodiversity conservation standards).

Investment in skilled labour or advisory services (e.g. meteorological advice/ agronomists/ other consultants)

Investment in vineyard monitoring regimes (including weather, phenological development and harvest records)

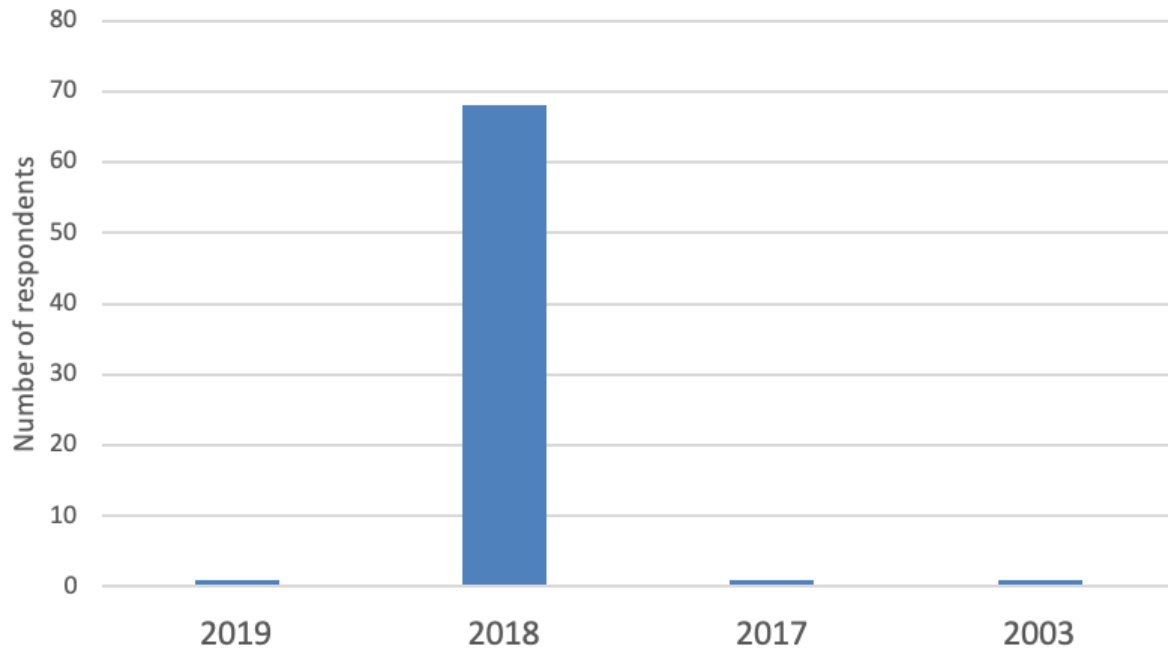
Planning in business strategy

Business diversification (e.g. wine tourism, winemaking, contract winemaking)

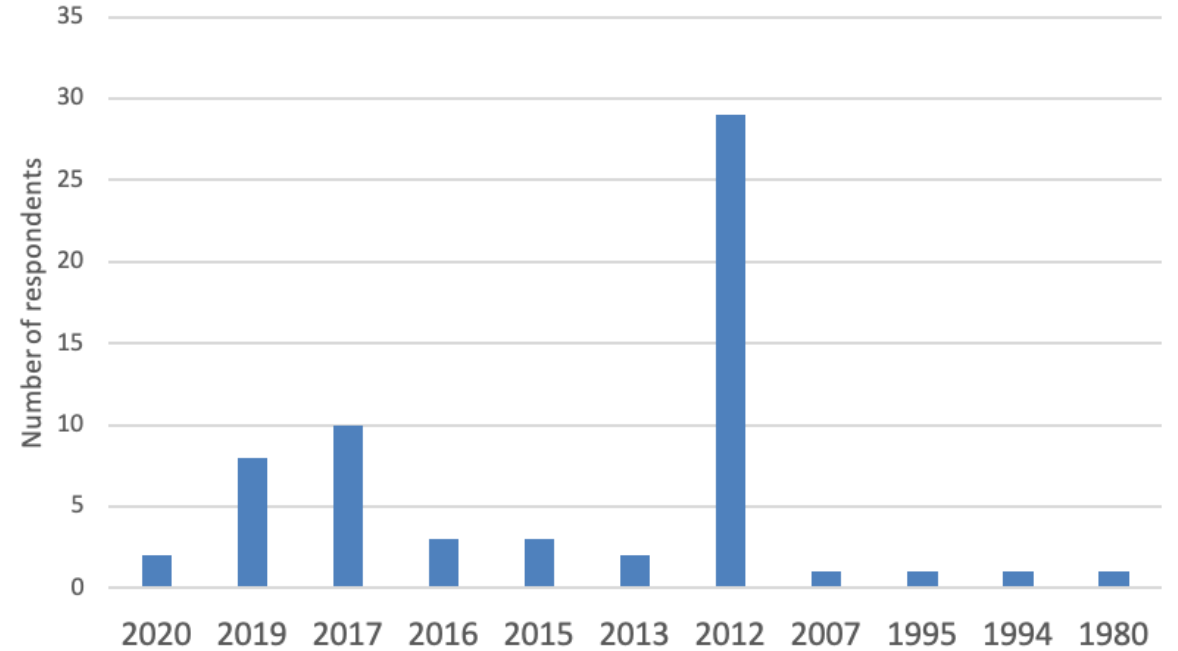
Business expansion

Investment in marketing and expanding customer base

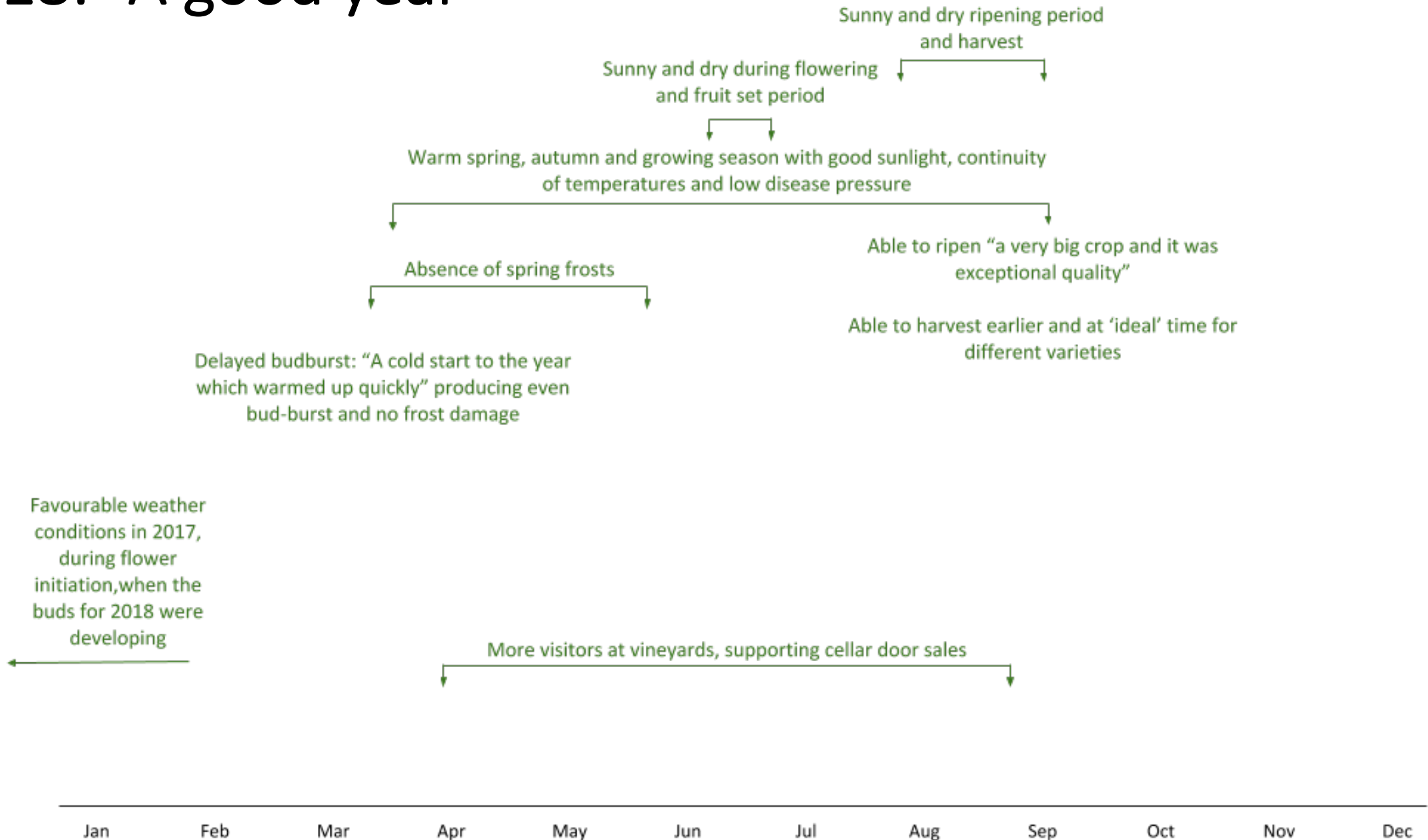
Since you started working within the sector, in what year did the UK experience the *most favourable* weather conditions for grape growing?



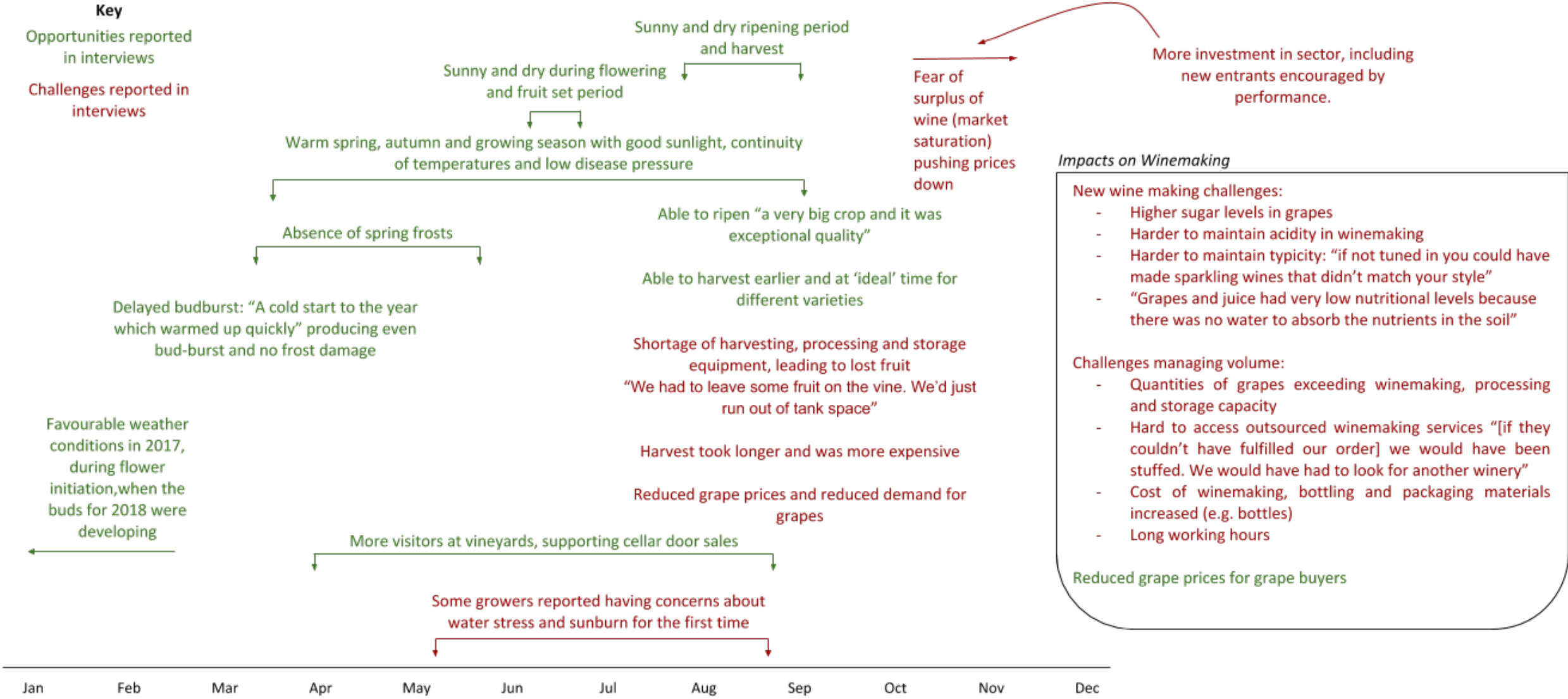
Since you started working within the sector, in what year did the UK experience the *least favourable* weather conditions for grape growing?



2018: "A good year"



Key
 Opportunities reported in interviews
 Challenges reported in interviews



Adaptation behaviours taken during 2018: Producers

Grape growers



New vineyard management techniques:

- Adjusted approach to fruit thinning (e.g. reduced fruit thinning to maximise yield; or continued fruit thinning as a risk mitigation strategy)
- Lighter use of fungicides and pesticides
- Changes to pruning techniques (e.g. reduced fruit thinning)
- Watered young vines and considered irrigation

Adjustments to harvesting:

- Harvested earlier
- Picked different grape varieties at their most optimal time to balance sugar/acidity

Investments in equipment, labour and knowledge:

- Investment in additional harvesting, processing and storage equipment
- Engaged consultants
- Took on new (temporary) workers
- Increased interactions with winemakers
- Use of short-term weather forecasting services

Changes to business strategy:

- Retained grapes to produce wines under own brand

Changes to marketing and selling:

- Adjusted prices
- Invested in relationship building with customers

Winemakers



Changes to the types of wine produced

- Made more still /red/vintage wines
- Made more blended wines (to balance sugar or to manage unexpected volumes where tank space inadequate)

Adjustments in approach to winemaking:

- Reduced chaptalisation (addition of sugar prior to fermentation to increase alcohol levels)
- Adjusted fermentation process (e.g. skipping malolactic fermentation)
- Experimented with new winemaking techniques and styles (e.g. lower-intervention wine making techniques)
- Released wines earlier (less time in cellar)

Investments in equipment, labour and knowledge

- Investment in additional processing, storage and wine making equipment and processes, including purchase of temporary tanks
- Took on new (temporary) workers
- Outsourced winemaking tasks or hired new or additional contract winemakers or services

Changes to business strategy:

- Released wines earlier (less time in cellar)
- Kept wine back in reserves, for future years when harvest was smaller
- Sourced grapes from additional or alternative sources
- Sold grapes that couldn't process due to capacity limitations

Changes to marketing and selling

- Marketing 'unique' qualities of wine
- Investment in marketing to expand and diversify consumer base and build relationships with new retailers and distributors
- Adjusted prices (e.g. increased prices on premium wines)

Adaptation behaviours taken during 2018: Other value chain actors

Input and service providers

<p>Opportunities and challenges:</p> <ul style="list-style-type: none">- Increased or decreased in demand for products and services, depending on business- Changes in the timing when products and services are needed
<p>Adaptation behaviour:</p> <ul style="list-style-type: none">- Expanded capacity to provide products and services (e.g. took on additional (temporary) workers).- Supplied products on credit- Prioritised customers- Increased or decreased cost of inputs and services- Adjusted prices of inputs and services- Invested in relationships and dialogue with customers to understand needs, opportunities and challenges

Independent wine sellers

<p>Opportunities and challenges:</p> <ul style="list-style-type: none">- Additional wine available for sale and distribution- Different types of wine available at different times
<p>Adaptation behaviour:</p> <ul style="list-style-type: none">- Bought more wine and invested in additional marketing and ran additional promotions- (Re)Negotiated prices- Established new business relationships and bought wine from new- Invested in relationships and dialogue with suppliers to understand opportunities- Built up reserves to support consistency of supply in the future

Learning from 2018

Grape growers

Site adaptations

- E.g. site expansion and use of new forms of (climate) information to identify ideal sites

Changes to vineyard management regimes

- E.g. Adjustments to production regimes to support resilience of soils/vines and/or to create unique marketable qualities
- E.g. Adjustments to pruning regimes and canopy management approaches

Business expansion and diversification

- E.g. Investment in marketing and expanding customer base

Winemakers

Investments in winemaking, storage processes and equipment

Adjustments to production and grape sourcing strategies

- E.g. to create unique marketable qualities, such as organic / low-intervention / vintage wines

Adjustments to the types of wine being produced and marketed

Investments in marketing, building linkages with retailers and distributors, attracting direct sales and expanding customer base

Input and service providers

Adjustments to pricing models

Developing new products and services

Increasing communication with customers

Restructuring processes of managing order confirmations and purchase orders

Independent wine sellers

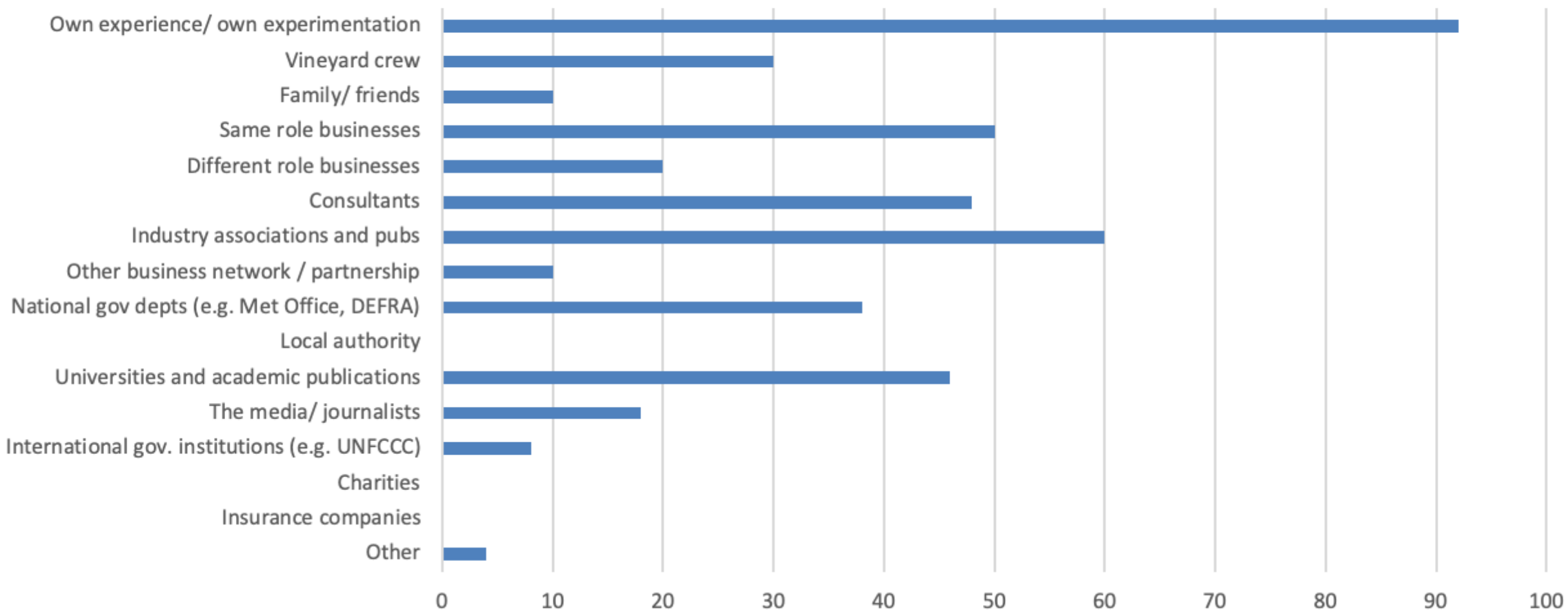
Investments in relationship building with suppliers

Sourcing wines from different or additional producers

Changes to ordering processes

Investments in marketing English and Welsh wines

Percentage of producers that report relying on each source of information when deciding what action to take to manage climate change



Adaptation behaviour in the UK Wine Sector: Some key findings

- UK grape and wine producers manage climate risk through a range of reactive (ex-post) and short-term anticipatory (ex-ante) adaptation strategies
- They are also taking notable steps to integrate longer-term climate change planning into their business decision making.
- Adaptation in the UK wine sector is strongly dependent on experience, experimentation and learning at the individual and business level. But producers are blending this experience with other forms of knowledge about climate change in adaptation decision making.
- Extreme events are also focal points for longer-term adaptation learning.



The UK wine sector still risks recreating lock-in seen in more established viticultural landscapes

- Information gaps in site and variety suitability remain
 - *“I now know that the chardonnay clone we planted is a late ripening clone – I didn’t have the knowledge to ask for the right ones”*
- Concentration on champagne varieties and sparkling wine
 - Overlooking varieties that may be better suited to climatic conditions: *“We are not looking at new disease resistant varieties. It’s hard to sell them”*.
 - Limited marketing investment in still wines
- Vintage only wines
- Development of Protected Designation of Origin (PDO) restrictions
 - *“We hope we can keep track of and control the quality of product and differentiate the product. Because in coming years there will be quite a lot of product in the market. So we can say this is from Sussex”*.
- Regulatory limits (e.g. chaptalisation restrictions, yield limits)



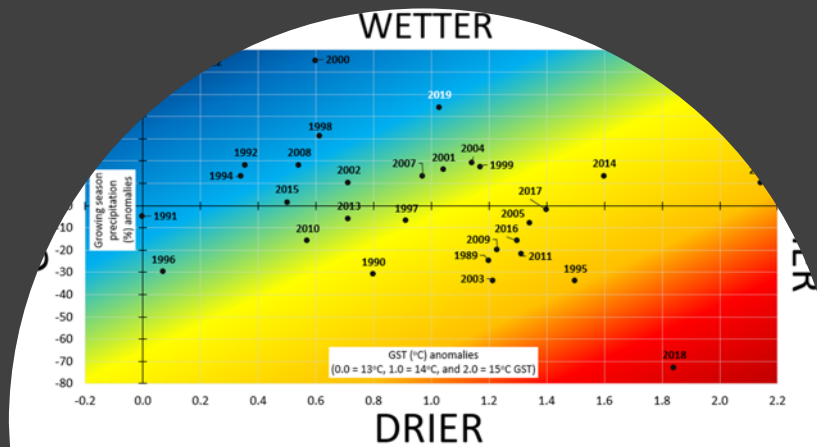
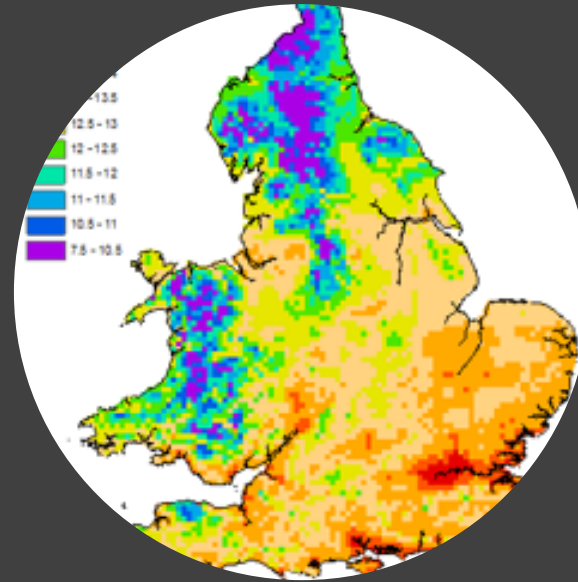
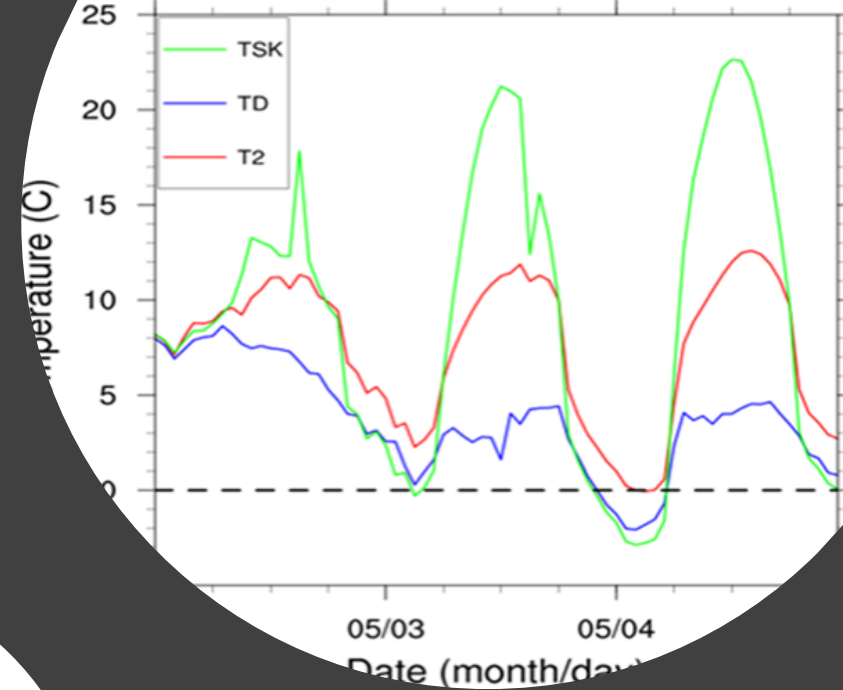
Translating climate data into information for decision-making in UK viticulture

Uses:

- Local to national viticulture suitability assessments.
- Varietal and wine style scoping.
- Frost risk analysis and protection recommendations.
- Identifying both risks and new opportunities.

Range of audiences:

- Growers and Vineyard Managers (Practitioners).
- Vineyard owners or potential owners (Investors).
- Policy actors such as Wines of Great Britain or National Parks (Strategic).
- The research community (Academic).



Translating climate data into information for decision-making in UK viticulture

- Getting planting right. Key decision components:
 - Land
 - Climate
 - Market
- Vines in the ground for >30-years.
- Riesling – a short case study of getting it wrong!
- Personal perspectives on decision making in a changing climate and adaptation potential.



With particular thanks to WineGB, our research participants and our funders

Prof. Steve Dorling: S.Dorling@uea.ac.uk

Prof. Declan Conway: D.Conway@lse.ac.uk

Dr. Alistair Nesbitt: alistair@vinescapes.com

Dr. Kate Gannon: K.E.Gannon@lse.ac.uk

Frances Trappey: frances@vinescapes.com



Website: www.ukclimateresilience.org/ / www.lse.ac.uk/granthaminstitute/resilient-wine/

Twitter: @UKCRP_SPF

YouTube: UK Climate Resilience programme

The UK Climate Resilience programme is supported by the UKRI Strategic Priorities Fund.
The programme is co-delivered by the Met Office and NERC on behalf of UKRI partners AHRC, EPSRC, ESRC.



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