Grantham Research Institute on Climate Change and the Environment

Centre for Climate Change Economics and Policy

April 2024

Policy brief

Adapting to climate change risk and opportunity in the UK wine sector

Summary

- The UK wine industry is now producing award-winning, internationally recognised wines, with warming temperatures a key factor in the industry's recent growth. Wine production is thus often seen as a rare sector in the UK for which climate change presents an opportunity.
- However, climate change will continue to pose wide-ranging challenges to wine production too: it is already leading to greater variability in growing conditions and more extreme weather events.
- The sector is working proactively to respond to climate change. Business leaders are embedding plans to cope with its impacts into their strategic decision-making and a range of sector-wide initiatives are recognising its significance. Even so, some of the ways in which the sector is developing may limit its resilience to changing conditions in the future.
- A rapidly warming climate means that over the next 20–30 years (within the commercially productive lifespan of a vine) growers and winemakers will need to take significant additional steps to enhance future resilience to climate change.
- Adaptive action could include making further changes to the grape varieties and wine styles being produced and increasing investment in the marketing of still wine.
- Climate change adaptation should also be placed at the heart of Protected Designation of Origin (PDO) certification requirements to avoid creating inflexible regulations that do not maximise the opportunities for viticulture under a changing climate and which risk early decisions having costly impacts later.
- As the UK wine sector continues to expand rapidly, climate variability could lead to periods of oversupply, impacting markets and prices for producers and the wider value chain – unless significant investment is made to establish new markets for UK wine.

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Policy briefs provide analysis on topical issues, presenting specific recommendations to inform ongoing policy debates. Drawing on the Grantham Research Institute's expertise, they summarise either our research findings or the state of knowledge about a particular issue.

This policy brief has been written by **Kate Gannon, Steve Dorling, Alistair Nesbitt, Declan Conway, Naylei Pena** and **Johannes Borchert.**

Introduction

Winemaking is an industry associated with tradition and terroir.[1] Now, climate change is transforming the face of global wine production, causing declines in some regions and presenting opportunities in others – the UK among them. However, the UK, a relative newcomer to winemaking in the modern era, faces challenges in adapting to climate change too. In this policy brief we set out the nature of these challenges and what more needs to be done to enhance resilience to climate change in UK viticulture. We draw from findings from the multi-partner CREWS-UK project.

The global context: climate change is redefining winemaking

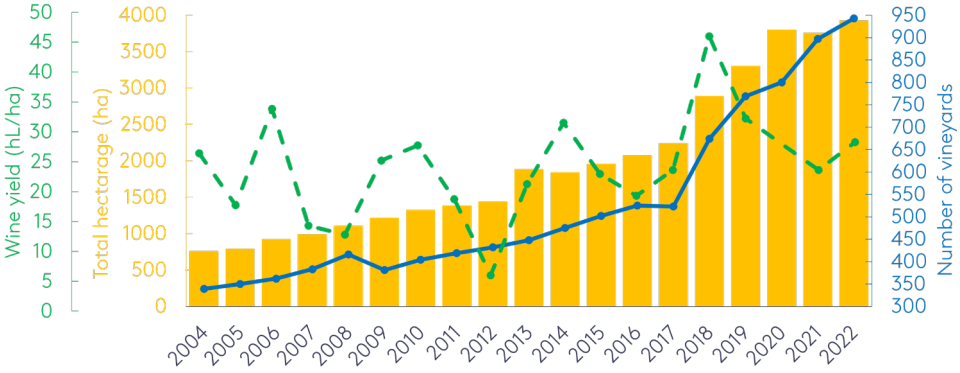
Wine grapes are highly sensitive to climate. Quality wine production is limited to areas with average growing season temperatures of 13–21°C, while individual grape varieties such as Pinot noir, Semillon and Merlot often have to be grown within an average temperature range of just 2–3°C to produce optimal ripeness and typicity.[2] Climate change means that many of the world's most famous wine regions are increasingly exceeding the optimal temperature range for the varieties and wine styles they are known for. This is bringing about substantial changes to the characteristics of regional wines and to the viability of production.

In recent years, established wine regions such as California, Spain, South Africa and Australia have been grappling with persistent droughts and wildfires, which have affected grape yields. Global wine production in 2023 is expected to have been at the lowest level for 60 years, owing to extreme and unfavourable climatic conditions during the growing season.

Excessive heat often results in wines that are high in sugar and alcohol. Wines produced in such conditions may also lack the desired quality and characteristic typicity of a region.

As global temperatures increase, climatically suitable production areas are migrating to higher altitudes and latitudes (the latter being advantageous for the UK), and the production and signature tastes of some classic wine production regions will prove increasingly difficult to maintain.

Figure 1. Vineyard numbers, total hectarage and national wine yield in the UK, 2004–2022*



**No wine yield data are available for 2020. Source: Nesbitt et al. (2022); data from Skelton (2020) and WineGB.*

"Global wine production in 2023 is expected to have been at the lowest level for 60 years, owing to extreme and unfavourable climatic conditions."

1. *Terroir* is a term that is used to describe the combination of elements in the environment, including climate, soil and topography, that are associated with the place in which wine is produced and which are generally considered to give wines their particular and unique qualities.

2. *Typicity* refers to the extent to which a wine reflects the signature characteristics associated with the region and grape varieties it is produced from.

The UK is benefitting from increasing viticultural opportunity

Recent climate trends have been positive for cool-climate and historically marginal viticulture areas such as England and Wales. In the UK, higher average growing season temperatures have enabled growers to more consistently ripen a range of commercially popular grape varieties (Nesbitt et al., 2016). This has led to rapid sector expansion (see Figure 1 above), particularly in the production of English sparkling wine which uses the classic Champagne grapes of Pinot noir, Chardonnay and Pinot Meunier.

Vineyard expansion has been concentrated in south-eastern and southern England but the footprint of commercial vineyards is also stretching further to the west and north of the country, currently reaching as far north as Yorkshire. Increasing yields – including 'bumper years' such as the 2018 harvest, courtesy of a record-breaking hot summer and warm autumn – and a growing profile of sparkling wines have further enhanced investor confidence in the sector (Gannon et al., 2023).

Future climate projections suggest that it will soon become possible to grow other commercially popular varieties, such as Sauvignon Blanc or Riesling. We also anticipate greater potential for still wine production – including still red wine – which generally requires riper grapes than sparkling wine does (Nesbitt et al., 2022).

> *"Without a shadow of a doubt, we wouldn't be planting in the volume and the bulk we are had we not got the confidence that we can now consistently ripen [these grapes] and produce [...] world class wines which can compete on the global stage."*
>
> - English wine producer interviewed in the CREWS-UK project

Rapid ongoing climate change threatens UK wine production

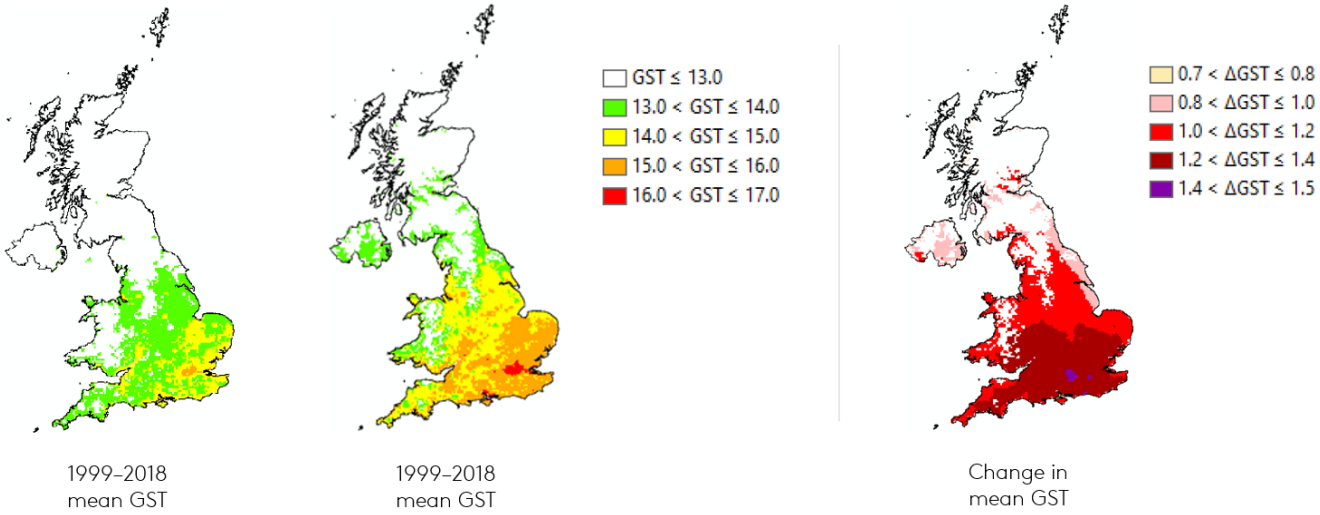
Despite the opportunities that a warming climate is offering UK winemaking, the sector remains at high risk from climate change and wine production is likely to remain precarious.

Key to this risk is the rapid expected rate of climate change over a short period of time. Many UK vineyards are projected to experience almost 1.5°C of warming over the period 2021–2041, compared with average temperatures from the previous 20 years (see Figure 2 below). The speed of this change poses challenges to wine producers, who tend to make long-term plans given that the commercially productive lifespan of vines often exceeds 30 years. It is also alarming considering the very narrow ideal temperature range of individual grape varieties. Anticipated ongoing warming suggests that UK producers may need to be prepared to make multiple changes to the grape varieties or wine styles they produce over time.

Sparkling wine production currently dominates in the UK today, which is often compared to the Champagne region of the 1990s. However, research suggests that over the next 20 years or so, the UK is likely to have temperature profiles more similar to those experienced 20–30 years ago in the central French region of Burgundy, and thus may be well suited to producing still Pinot noir wine. Comparatively, the average growing season temperatures that were perfect for making high-quality sparkling wine with Pinot noir and Chardonnay in the Champagne region from 1996–2015 might only occur in large parts of south-eastern England in cooler years (Nesbitt et al., 2022).

DENBIES VINEYARD, SURREY, ENGLAND.
PHOTO: STEFAN CZAPSKI/GEOGRAPH.CO.UK

Figure 2. Anticipated change in average growing season temperature between the observed period (1999–2018) and projected period (2021–2041)



Notes: GST = average growing season temperature. Δ indicates the difference between the two temperatures.
Source: Nesbitt et al. (2022).

Challenges of climate variability and erratic production

In addition to increases in average temperatures, climate change is likely to lead to greater climate variability and more extreme weather events, including extreme temperatures, heavy rainfall and droughts at key moments in the growing season. These are likely to alter the timing, duration and characteristics of recurrent seasonal and grapevine lifecycle events. Extended wet periods risk soils becoming waterlogged, with adverse impacts on vine health and productivity. Warming temperatures also bring the threat of new pests and diseases and may extend the geographical range of such risks.

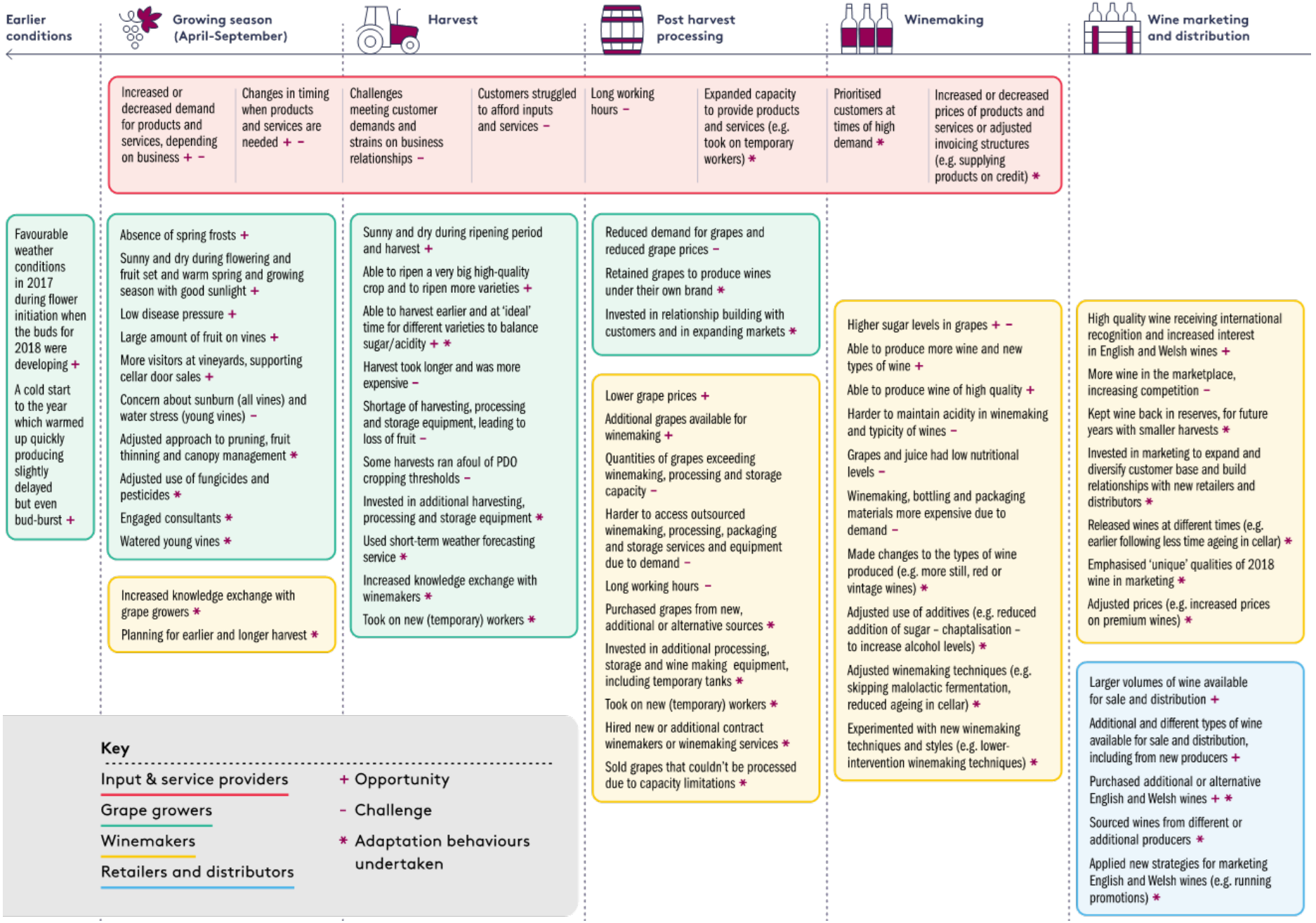
These climatic factors mean the UK wine sector can expect ongoing high levels of variability in growing conditions, leading to erratic production with occasional high losses, some bumper years, and differing volumes of wine produced year-on-year. It will also be harder under these conditions to produce wine of a consistent typicity and quality within the ideal 'norms' of vintage variability.

Our research shows that this variability has impacts across wine sector value chains, affecting stakeholders from input and service providers to sellers. Variability creates large swings in demand and supply for different goods and services that are difficult for businesses across the sector to manage.

These challenges are felt even in bumper years. Figure 3 overleaf maps the wide sectoral impacts of the exceptionally grape-friendly growing conditions in the UK in 2018 that led to record yields. It shows that, despite the sector as a whole performing very strongly, within it there were winners and losers, and businesses experienced challenges as well as opportunities. Some businesses, for example, struggled to access or keep up with demand for inputs and services such as contract winemaking. Meanwhile, some independent grape growers, who sell their grapes to winemakers, but do not have established markets or contracts for their grapes, struggled when the price of grapes dropped and many of their potential buyers could not buy or process any more grapes.

"Climatic factors mean that the UK wine sector can expect ongoing high levels of variability in growing conditions, leading to erratic production."

Figure 3. Impacts along the value chain from the 2018 bumper harvest in the UK



Source: Gannon et al. (2023).

As the sector continues to expand rapidly, large swings in production arising from bumper years could lead to periods of oversupply, impacting markets and prices for producers and the wider value chain – unless significant investment is made to establish new markets for UK wine.

Demand and supply effects are also likely to be compounded in the future as climate change impacts other products required by the sector, such as cork.

Decisions made by wine producers now will affect their future climate resilience

The ability of UK wine businesses to successfully adapt to the challenges of future climate change will be influenced by actions they take now. Investments in technologies, infrastructure and adaptation strategies have associated time and resource costs that cannot always be recovered easily. Such barriers can lead to path dependencies, whereby organisations are incentivised to continue with their current strategies, and risk 'adaptation lock-in'.[3]

In the wine sector, decisions such as where vineyards are planted, which grape varieties, clones and rootstock are planted, how they are planted (e.g. spacing of vines) and which equipment and technology is purchased can all involve large outlays, making it hard for businesses to change course despite the decreasing suitability of these investments as the climate changes.

Like infrastructure, vineyards have a long investment horizon: vines that were planted 30 years ago are often still producing grapes today. So, the grape varieties, clones, rootstock, vineyard locations and planting strategies chosen now need to be suited to future climate conditions too.

Adaptation lock-in can also occur if an industry adopts certain standards or practices that make it hard for businesses to deviate from a prescribed production method. Many longer-established wine regions are now too hot for the dominant grape varieties they are known for. Options for climate adaptation are limited in these settings, as varieties, wine styles and production methods are often entrenched through appellation-based regulations and PDO certifications.

Producers often adopt PDO certifications to enhance their commercial profile. But these typically impose strict regulations that restrict producers from transitioning to grape varieties better suited to a changing climate or from relocating their vineyards (e.g. to higher latitudes). In many European wine regions, irrigation, which could lessen the impact of increasingly common droughts, is strictly regulated by PDOs. Yield limits, which specify maximum volumes of grapes or wine that can be produced per unit area of vineyard, are also common.

The UK wine sector is preparing for climate change but risks recreating patterns of adaptation 'lock-in'

Businesses in the UK wine sector are highly aware of the risks and opportunities of climate change and are undertaking wide-ranging actions to prepare their operations for these impacts. Climate change informs many decisions, including the products and services offered, the choice of equipment, and contracting and pricing decisions (Gannon et al., 2023). Sector-wide initiatives such as the Sustainable Wines of Great

"The grape varieties, clones, rootstock, vineyard locations and planting strategies chosen now need to be suited to future climate conditions."

3. The UK Climate Change Risk Assessment defines adaptation lock-in as emerging from "early actions or decisions that involve long lifetimes or path dependency, which will potentially increase future risk or vulnerability and that are difficult or costly to reverse later" (Watkiss and Betts, 2021).

Britain scheme also show strong commitment to climate change planning, although to date these have been more focused on mitigation and sustainability objectives than on adaptation.

Producers in the young and less-established UK wine sector arguably have more freedom than those in many well-established wine regions to define wine tastes, styles and production and marketing strategies that maximise the opportunities of warming climates and mitigate climate risks. However, some strategies that are being adopted in the UK sector are likely to make it harder for production to continue evolving with the changing climate.

To date, investments in vineyards, production equipment and marketing strategies have been primarily directed towards the traditional methods of sparkling wine production used in the Champagne region. Sunk costs of infrastructure investments and pricing pressures[4] mean that the need to transition to alternative wine styles, such as still wines, could prove challenging for the sector.

In this rapidly growing industry, concerns about market saturation resulting from production exceeding established demand – and the related impacts on industry profitability – are gaining traction. In this landscape, UK producers are striving to distinguish themselves from their competitors by producing wines that can be marketed with unique characteristics. In the pursuit of distinctiveness, they risk locking themselves into specific production systems that may limit their future adaptation opportunities.

The 'English Quality Sparkling Wine' PDO, for example, currently replicates inflexibilities seen in more established wine regions by restricting the grape varieties that producers are approved to cultivate. It is also associated with maximum yield thresholds, which some producers exceeded during the hot summer of 2018. The 'Sussex' PDO label granted in 2022 mandates that wine must be crafted exclusively from grapes grown in East or West Sussex, meaning that producers do not have the option to source grapes from multiple counties as a risk-mitigation strategy, for example during years when a specific area suffers frost damage.

Research also suggests that many vineyards in the UK are sub-optimally located to be sufficiently resilient to climate risks (Nesbitt et al., 2018).

> *"Viticulture here is geared up towards making a wine with a current style. So people are [...] bringing in sparkling varieties, especially with clonal selection, that relate to the climate that they are dealing with here and now. And they're creating a market for that style... [But] we might have moved beyond the best conditions."*
>
> - UK wine producer interviewed in the CREWS-UK project

Recommendations

In many ways, the UK wine sector is a pioneer when it comes to action on climate change, and English and Welsh wines have an opportunity to prosper in the context of struggling international markets. Yet with temperatures set to continue rapidly rising, more action is needed to heighten the climate suitability of wine production and build a resilient wine industry for decades to come.

- **It is essential that the UK wine sector is informed by long-term decision-making that integrates climate change adaptation needs into its design and development.** This can help the sector to avoid

"More action is needed to heighten the climate suitability of wine production and build a resilient wine industry for decades to come."

4. The focus on sparkling wine in the sector to date has partly been driven by the need to uphold premium prices amidst relatively low yields.

the climatic vulnerabilities that many Old and New World modern commercial vineyards are currently experiencing as a result of failing to account for future climate change.

- **WineGB and other sector bodies should prioritise climate adaptation within UK wine sector policy, alongside sustainability considerations and climate mitigation.** In particular, adaptation planning should be at the heart of decision-making and governance on PDOs.
- **At this moment of high investment in UK wine production and sector expansion, producers need to consider future climate conditions when choosing grape varieties, rootstock, clones and vineyard locations.** As vines live and produce for decades, making planting decisions that account for future climate change risks is critical to the long-term resilience of the sector.
- **Existing preferences for dense planting should be balanced against the need to ensure sufficient space for ongoing adaptive canopy management**, for example to manage ventilation and light penetration and to mitigate the risks to grapes from humidity, dampness and sun damage.
- **Wine choices and preferences will likely need to evolve with the changing climate, so flexibility to adjust to the impacts of long-term climate change must be integrated into sector decisions** such as selecting sites and varieties, and marketing strategies. Marketing investments are likely to be needed for UK still wine.
- **Collaboration within the UK wine sector is the best way to manage the risks and opportunities of climate change.** Adaptation cannot happen in isolation as many businesses are dependent on others for knowledge and resources. Building resilience at a sector level is vital given climate change produces both winners and losers – and variability means that often those who benefit at one time struggle at another.

References

Gannon K, Conway D, Hardman M, Nesbitt A, Dorling S and Borchert J (2023) Adaptation to Climate Change in the UK Wine Sector. *Climate Risk Management* (42): 100572.

Nesbitt A, Kemp B, Steele C, Lovett A and Dorling S(2016) Impact of recent climate change and weather variability on the viability of UK viticulture – combining weather and climate records with producers' perspectives. *Australian Journal of Grape and Wine Research*. pp. 324–335. doi:10.1111/ajgw.12215.

Nesbitt A, Dorling S and Lovett A (2018) A suitability model for viticulture in England and Wales: opportunities for investment, sector growth and increased climate resilience. *Journal of Land Use Science* (13): 414–438.

Nesbitt A, Dorling S, Jones R et al. (2022) Climate change projections for UK viticulture to 2040: a focus on improving suitability for Pinot noir. *OENO One* (56): 69–87.

Watkiss P and Betts R (2021) *Technical Report Chapter 2: Method. in UK Climate Risk Independent Assessment [CCRA3]*. Eds. Betts R, Haward A and Pearson K. London: Climate Change Committee.

For further graphics showing the impacts of climatic conditions on UK wine sector supply chains, see: www.lse.ac.uk/granthaminstitute/publication/adapting-to-climate-change-risk-and-opportunity-in-the-uk-wine-sector.

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The authors thank WineGB and the interview and survey participants who supported production of this work. The authors also thank Peter Hayes, Sally Wright and Will Ingram for review and constructive comments on this brief. This policy brief was produced through the CREWS-UK project funded by the UK Natural Environment Research Council as part of the UK Climate Resilience Programme. Further information on the research underpinning this work can be found at: www.lse.ac.uk/granthaminstitute/publication/adaptation-to-climate-change-in-the-uk-wine-sector/.

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Authors' declaration

Dr Alistair Nesbitt is CEO of Vinescapes Ltd. Vinescapes provides both strategic consultancy and operational services to the UK wine production sector. Professor Steve Dorling is Professor of Meteorology at the University of East Anglia and CEO of Weatherquest Ltd. Weatherquest support viticulture clients with weather and climate services through Vinescapes Ltd. The other authors declare no potential conflict of interest.

This policy brief is intended to inform decision-makers in the public, private and third sectors. It has been reviewed internally and externally before publication. The views expressed in this brief represent those of the authors and do not necessarily represent those of the host institutions, funders or reviewers. Any errors and omissions remain those of the authors.

This brief was first published in April 2024 by the Grantham Research Institute on Climate Change and the Environment and the Centre for Climate Change Economics and Policy.