HSBC Global Research

5 September 2023

ESG Summer Series

Wine: Uncorking the impact of climate change

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Global

- "Old world" wine regions like Burgundy are particularly at risk from rising temperatures that can radically change flavours
- Some measures can be taken, like using irrigation systems, but ultimately wine growing is likely to move to cooler locations
- The wine world is also under pressure to be more sustainable, like reducing pesticides and moving away from glass bottles

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*This is the 9th report in our **ESG summer series** – looking at sustainability issues in less obvious places. These issues could grow to become bigger trends in the future.*

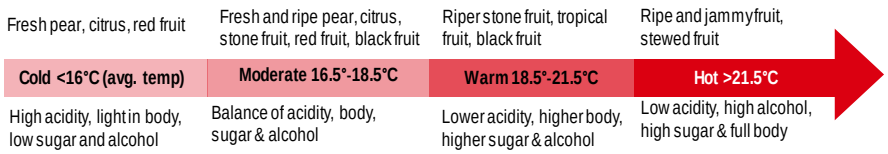
A taste of terroir…: The unique climate to each vineyard determines the taste, aroma, colour, and, above all, quality of wine. Meanwhile, many producers continue to use traditional practices that have lasted hundreds of years. All of this helps to make wine so popular today – but the industry is increasingly threatened by climate change.

…and climate change: Rising temperatures are hitting the wine world by increasing sugar levels in grapes, which turns into higher-alcohol and less-balanced wines, and can even lead to "overcooked" fruit notes. Extreme weather events can impact too. In California, smoke taint was found in bottles exposed to forest fire smokes, while in Italy, sunburnt grapes from extreme heat and excess sun brought dry and bitter notes.

Building climate resilience: Irrigation systems and more shade can help protect grapes from the heat, but ultimately some varietals, like the fragile Pinot Noir, will likely still struggle. Hence, we could see a shift away from traditional wine growing regions towards cooler locations that were not previously considered wine-growing territory. Think England, Norway, and Finland, which are all experiencing wine-making success. One study found that there could be a 68% decline in land suitable for viticulture around the Mediterranean, where 40% of global vineyards are located, by 2050.

A shift towards sustainable wine: Pressured by climate change, tradition, and consumers, many vineyards are also using sustainable agriculture methods. Reducing pesticides, and adopting organic and biodynamic practices can have a real impact on mitigating climate change, enhancing biodiversity, and restoring soil. There are now a number of sustainable certifications and organic wines that are quickly gaining market share. Less of a priority though is moving away from glass bottles and towards more sustainable wine packaging; however, this is the largest source of emissions for the industry. In our view, stakeholder pressure to adopt sustainable packaging will be key to improving the sustainability of wine.

1. Rising temperatures impact wine flavour



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A Burgundy bust?

Climate change is causing winemakers to reimagine the future of wine. Will the traditional winegrowing regions persist? Will jammy and sweet be the wine flavours of the future, and will consumers even want to drink it? Will adaptation measures preserve the wine we know today? In this short report, we kick off by looking at the grapevine, a particularly sensitive crop.

The changing environment poses a risk to existing varieties and wine styles

Rising temperatures, increased rainfall, and more intense weather events like extreme heat, heavy rain, and drought all impact not just the quality of grapes, but their quantity too. Certain varietals, like Pinot Noir used to make high-priced red Burgundy, have particularly narrow temperature ranges to grow well (Chart 4).

2. Climate change and wine

Climate change impacts	Impacts on vine phenology	Impact on grape and wine product
Temperature increases	-Temperature becomes unsuitable for certain varietals to grow -Cooler regions may become more suitable -Shortened ripening cycle -Increased risk of fungal infections -Increased water needs	- Acceleration/increase in sugar content and alcohol - Decrease in acidity -Tannins and anthocyanins, which impact wine flavour and colour, are found in the skin of grapes and won't develop properly (smaller berries=more skin to juice) -Changes in aroma and coloration/pigment levels -Harvest loss and reduced wine production
Extreme heat or more direct sunlight	-Sunburnt or shrivelled fruit -Increased water use	- Increase in anthocyanins - Dried fruit notes and dull wine - Poor grape and wine quality - Changes in colour and taste of wine - Harvest loss and reduced wine production
Decrease in winter frosts	-Spread of pests/ insect-borne diseases -Shortened ripening cycle	- Harvest loss and reduced wine production
Precipitation increases	- Increased vegetation growth and therefore more fruit shade - Soil health - nutrient loss and erosion, root damage to plant - Increased risk of disease/fungal growth - Later ripening season	-Harvest loss and reduced wine production -Increase in berry weight -Increase in acidity -Poor wine quality
Drought and aridity	-Limited vegetation growth -Stunted shoot and fruit growth - berry size and yield -Reduce soil nutrients	-Harvest loss and reduced wine production -Increase in tannin and anthocyanin -Increase in acidity -Changes in colour and taste of wine
Frequency and intensity of extreme events	- Damaged vines and fruit	-Harvest loss and reduced wine production -Changes in wine notes- i.e. smoky notes found in harvests exposed to forest fire smoke

Source: IPCC Sixth Assessment Report, Climate Central

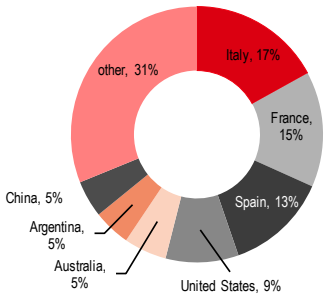
Where's most at risk?

The Mediterranean wine growing region is an area of significant risk

Wine production is especially prominent in the Mediterranean, where 40% of global vineyards[1] are located and which encapsulates the majority of Italy, Spain, and parts of France, the top 3 wine producing countries in the world (chart 3). However, the region is projected to become warmer and dryer, suggesting shorter grapevine growth cycles and grape harvest days, a reduction in yields, and a shift of premium wine production areas towards higher elevations[2]. Additionally, vines will likely demand more water with predicted precipitation declines and higher evaporation due to warmer climates; all of this brings increased water stress[3].

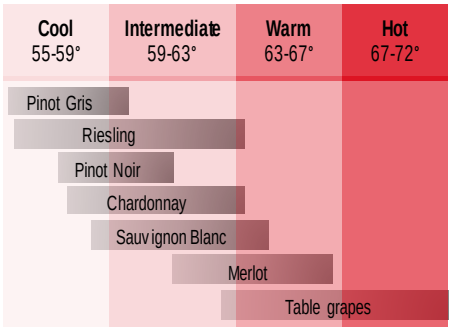
1 Santillán, D. & Sotés, et al. Adapting viticulture to climate change in the Mediterranean region, 2019
2 Ferrise, R., et all, Climate Change and Grapevines: A Simulation Study for the Mediterranean Basin. Journal of Wine Economics, 2016
3 Droulia F, Charalampopoulos I. Future Climate Change Impacts on European Viticulture, Atmosphere, 2021

3. Wine production by region, 2023



Source: World Population Review, HSBC

4. Optimal wine grape temperature over the growing season



Source: Climate Central, HSBC

What does this mean for the industry?

Adaptation. The good news is there's quite a lot that winemakers can do to cope with climate change. Irrigation systems, increased shade for grapes, radiation-reducing row orientations, and heat resistant grape varietals can all be useful strategies. Additionally, additives can be introduced to enhance wine flavours if there's not ideal environmental conditions and moving grapes to cooler regions can also be considered. Indeed, wine may increasingly be grown in the northern and southern hemisphere, and away from more traditional winegrowing regions of the Mediterranean. According to one study, the Mediterranean region's land suitable for viticulture could decrease 68% by 2050 under the current climate policy, versus Northern Europe's land suitable for viticulture, which could increase by 99% (Chart 6)[4]. Indeed, places, like England, Norway, and Finland, not typically seen as being suitable for producing quality wine, are experiencing longer growing seasons and success in winemaking[5].

Adapting to climate change could mean losing wine traditions in some regions

Adaption strategies look different across regions:

- **"Old world" wines**: The majority of wine produced is in "old world" winegrowing regions (Europe & Middle East), where centuries of winemaking traditions are enshrined with strictly defined appellation areas and regulations to preserve the unique flavour profiles of wine from their area. Regulating bodies often control the grape varietals grown, farming practices used, and crop yields, to name a few. Changes are being made in the face of climate change, for example towards accepting certain drought resistant varietals. However, it's slow going as there is resistance from growers to move away from long-held practices.
- "**New world" regions**: Without traditions and regulations, "new world" wine regions, like North America, Australia, and New Zealand have more flexibility to adapt to changing climactic conditions – like utilizing varietals that grow best in their changing climate.

In our view, adapting to climate change while preserving the tradition and well-recognized flavours of their regions will be challenging for "old world" winemakers. "New world" regions that are able to adapt to climate fluctuations easily and experiment with new growing techniques will be more resilient to climate pressures, in our view.

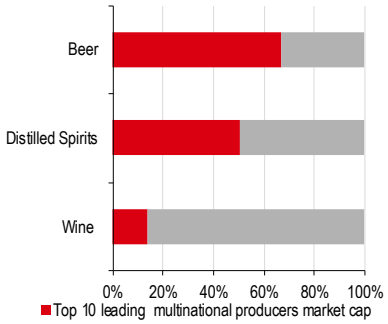
A more consolidated future?

The artisanal nature of wine, as a result of the diversity of geography and tradition, brings fragmentation to wine production – hundreds of thousands of wine producers are acting unilaterally to produce wine[6].This is different than other alcoholic beverage markets, like beer and distilled spirits, where a few big producers dominate the market. As winemaking traditions

4 Lee, Hannah, et al. Climate change, wine, and conservation, PNAS, April 2013
5 Hard-hit by climate change, winemakers turn to sustainability to ride the storms, Reuters, September 2022
6 Jernigan D, Ross CS. The Alcohol Marketing Landscape: Alcohol Industry Size, Structure, Strategies, and Public Health Responses. J Stud Alcohol Drugs Suppl, 2020

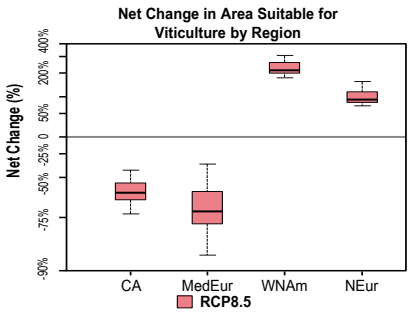
and practices are challenged by climate change and vineyards become more difficult to maintain, working unilaterally may become more difficult. Better collaboration between winemakers will be key to making the wine market more resilient. In our view, this could increase consolidation in the wine market, so that it more closely resembles the distilled spirit and beer markets.

5. Market concentration in the alcohol sector, 2016



Source: Boston University School of public Health, HSBC

6. Net change in area suitable for viticulture



Source: PNAS, HSBC

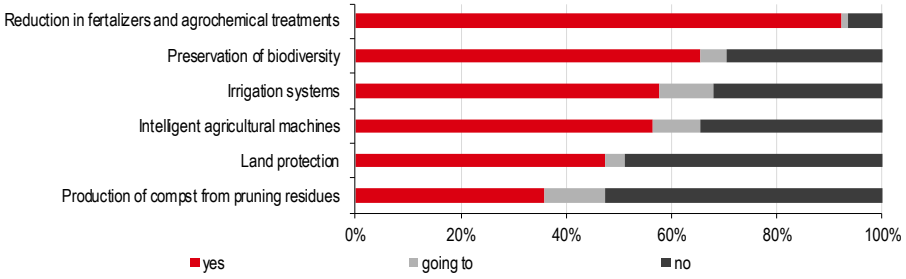
A sustainable future for wine

As the link between the wine industry's future and a healthy environment is increasingly acknowledged, efforts to implement sustainable strategies are being made across the wine supply chain – vineyards, wineries, packaging, and transport.

Vineyards

Many vineyards are shifting away from chemical fertilizers (Chart 7) and towards more sustainable agriculture techniques such as no-till methods and inter-row planting to reduce soil erosion, supply nutrients, and improve biodiversity. Big names, including Moët Hennessy, are integrating regenerative agriculture schemes in their growing regions. Martell Mumm Perrier-Jouët, for example, has started a four-year programme to trial climate-resistant grape varieties, cover crops, and using precision farming technology in Cognac and Champagne. Additionally, many designated appellation areas are taking on sustainability initiatives. For example, French appellation areas, including Champagne, are aiming for 100% of growers to have a certified environmental approach by 2030 (see page 5).

7. Sustainable vineyard practices used by Italian vineyards



Source: "Environmental practices in the wine industry: an overview of the Italian market", British Food Journal, 2020, HSBC

Wineries

Wineries are redesigning their cellars with sustainably in mind, such as to take advantage of the natural underground cooling effect and to use gravity instead of pumps to move crushed grapes into tanks. While adopting renewable energy has been less popular among wineries[7], there are wineries like Chateau Montrose in Bordeaux that are using solar panels and geothermal energy for their winemaking process.

Wine tourism can be quite carbon intensive

Beyond actual winemaking, millions of tourists visit wineries each year, which can be can quite carbon intensive given transport, accommodation, etc. A study on Austrian wine tourism, estimates the industry generates 790,000 tonnes of greenhouse gas emissions each year – one-third of the industry's total carbon footprint[8]. The majority of vineyards globally offer tourism activities, such as wine tastings and guided tours, and increasingly sustainability considerations are playing a larger role (see *Heat on holidays: tourism in a changing climate*, 3 August 2023).

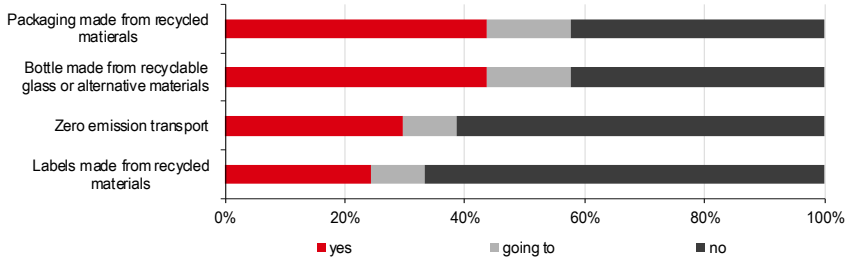
Transport & packaging

Transport and packaging emissions contribute to a large part of the industry's emissions footprint — many wine regions estimate over 50% of total emissions come from this. The market preference for glass bottles largely drives the emissions, both in the production of glass bottles, and the transportation of bottles given they are heavy.

Sustainable wine packaging is emerging, but given less effort compared to other areas

Using alternative packaging, like paper bottles, pouches, refillable containers and recycled plastic is an emerging trend. Moët Hennessy's Chateau Galoupet estate in Provence is the first to sell a premium wine in flat bottles made from recycled plastic. The bottle has a smaller GHG footprint, takes up 40% less space and is 90% lighter than a glass bottle. Additionally, the global canned wine market has experienced significant growth in recent years[9]. A survey of Italian wine producers showed there was an interest, but a lack of overwhelming support for alternative packaging solutions (Chart 8). In our view, moving to alternative wine packaging will be challenging, but efforts are being seen and will continue with increased stakeholder pressure.

8. Adoption of environmental practices in bottling and distribution by Italian wine makers



Source: University of Florence 2019 study, HSBC

Wine certifications

As a result of the attention on sustainability within the wine industry, a variety of certifications have developed. Organic and biodynamic sustainable certifications, which focus on vineyard operations and winemaking methods, are most popular. For example, Agriculture Biologique (French), Austria Bio Garantie (Austria), Euro Leaf (EU), and USDA Organic (US) are organic certifications, and Demeter, Biodyvin and Respekt-Biodyn are biodynamic certifications.

Among the wine regions, "old world" wines dominate the sustainable wine segment. In our view this makes sense given their focus on their unique environment or "terroir", climate change impacts, and the EU Green Deal goal for at least 25% of agriculture land to be under organic farming by 2030. Nonetheless, increase pressure by consumers demanding sustainable wines, means other wine regions are stepping up.

7 Hochschule Geisenheim University, Wineoutrism.com, HSBC
8 Journal of Sustainable Tourism, The double-edged sword of wine tourism: the economic and environmental impacts of wine tourism in Australia, 14 May 2021
9 Hard-hit by climate change, winemakers turn to sustainability to ride the storms, Reuters, September 2022

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