# ABSTRACT – KAUSHAL DROLIA


***Motivation:***

My motivation for choosing the topic of water scarcity and its impact on winemaking and viticulture stems from the noticeable gap in available literature on this subject, particularly during my WSET Diploma studies. While the program provided an extensive foundation in viticulture and winemaking, it became clear that the specific issue of water scarcity was not covered in great detail, despite its growing relevance in the industry. This is understandable from an academic perspective, given that water scarcity is a complex and broad topic that extends beyond the scope of the Diploma curriculum. However, it highlighted to me the pressing need for deeper exploration into how water availability affects wine production, particularly in the context of climate change.

Water scarcity, fueled by climate change, is not only an urgent issue for the wine industry but also for other sectors that rely on intensive resource consumption. The wine industry has seen successful innovations and adaptive strategies in response to these challenges, from water-efficient irrigation techniques to more resilient grapevine varieties. Yet, despite these advancements, there remains significant work to be done in establishing universal regulations and best practices that can be widely accepted and implemented across diverse wine regions. This gap in both academic and regulatory frameworks drove me to focus on water scarcity in viticulture, as I believe understanding these issues will be crucial for the future of the wine industry and its sustainability.

***Problem/ Objective:***

Water scarcity has emerged as a critical issue confronting the global wine industry, with climate change and shifting weather patterns intensifying its impact across major wine-producing regions. This study explores how prolonged drought conditions, reduced rainfall, and increasing water demand have reshaped viticultural practices and economic outcomes in areas such as South Africa, Australia, Spain, and the United States. Traditional approaches such as dry farming and the use of drought-resistant rootstocks are being revisited and adapted to meet contemporary challenges, while innovative techniques like regulated deficit irrigation (RDI) and partial rootzone drying (PRD) offer water-saving benefits but also introduce complexities, including heightened salinity risks in certain soils. Through analysis of case studies and current literature, this research highlights the trade-offs and considerations associated with adopting these methods under different environmental and economic conditions. The thesis further examines how modern technology contributes to enhancing water management in viticulture.

***Methodology***:

The methodology of my thesis is primarily qualitative and secondary research based. It relies extensively on academic, industry and institutional literature. These include peer reviewed journal articles, scientific publications, industry reports and white paper reports. Data were collected through academic databases such as JSTOR, ScienceDirect, and institutional websites including the International Organisation of Vine and Wine (OIV), and national viticulture bodies. Case studies and real-world examples from wine regions such as Australia, California, South Africa and the Mediterranean have been included. Rather than conducting experiments or interviews it interprets and analyzes existent findings to draw conclusions about impact of water scarcity and its potential solutions. Access to direct primary data is limited due to geographical and temporal constraints.

***Content:***

This thesis looks at how water scarcity affects grape growing and winemaking from different angles—plant health, farming practices, and the wider impact on people and businesses. It begins by outlining the water needs of grapevines and how water stress affects vine development, grape composition, and ultimately wine quality. Through regional case studies from drought-prone areas such as southern Spain, South Australia, and California, the thesis investigates how producers are responding to increasing water limitations. These include both traditional and technological adaptations such as dry farming, regulated deficit irrigation, and the use of drought-resistant rootstocks. Interviews with industry professionals complement the literature review and provide insight into practical challenges, decision-making processes, and the evolving relationship between climate pressures and vineyard management. The final chapters analyze the effectiveness of these strategies, assess barriers to implementation, and underscore the need for more coordinated, long-term approaches to water governance in the wine industry.

***Conclusion:***

Precision irrigation, artificial intelligence (AI), and blockchain are emerging as powerful tools for optimizing irrigation efficiency, improving transparency in water distribution, and forecasting drought conditions. AI-driven solutions allow vineyard managers to leverage data from soil sensors, drones, and satellite imagery to make informed decisions about irrigation timing and volume, thus minimizing waste while preserving grape quality. Despite their potential, these technologies face barriers to adoption, including high initial costs and limited accessibility for small-scale producers.

The findings underscore the importance of integrating traditional knowledge with technological innovation to ensure long-term resilience. Ultimately, the global wine industry must navigate a complex

landscape of environmental, technological, and regulatory factors to secure a sustainable future in an increasingly water-scarce world.