SUSTAINABILITY AND THE EMERGENCE OF THE TEXAS WINE INDUSTRY: AN EXPLORATION OF THE TRANSITIONAL MOMENTS WITH A FOCUS ON THE HILL COUNTRY AND HIGH PLAINS REGIONS

by

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I would like to thank wine for being the glue holding 2020 together.

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ABSTRACT

The Texas wine industry dates back to the 17th century when the first grape vines were planted by Spanish missionaries (Crain & Crain, 2013). Although wine has a long history in Texas, the commercial industry was relatively dormant until recently. As of 2019, Texas is home to over 500 wineries and 350 vineyards, with over 5,000 acres bearing grapes (Texas Wine and Grape Growers Association, 2020). There are now eight established American Viticulture Areas (AVAs) in the state (TDA, 2020), suggesting the geographic differentiation between the wine producing regions. Given the geographic scale of Texas wine-growing region, I will focus on the two largest AVAs in this study and apply a sustainability lens (economic, environmental, and social transitions) to improve our understanding of how these *"fermented landscapes"* (Myles, 2020) have evolved with a primary focus on the last three decades.

When comparing the High Plains and Hill Country AVAs, several important differences emerge: The High Plains AVA, located in a region historically known for large scale agriculture and cattle ranching, has a much greater level of production, but lacks the general social and economic infrastructure required to build a successful wine tourism industry (Overton, 2020); in contrast, the Hill Country AVA, which has significantly fewer vineyards, can better meet the needs and demands of a wine tourist. The needs and demands of a wine tourist include proximity to larger urban areas (like Austin, San Antonio, and Houston) and having other forms of recreation nearby (such as shopping, outdoor activities or historic attractions), while also ensuring appropriate

accommodation, dining opportunities, and varying transportation options readily available thus cultivating a sense of a "wine country" identity (Myles & Filan, 2019). The Hill Country AVA in Texas meets the demands of tourists better than the High Plains AVA and is home to the majority of wine production, however the region only produces a tiny fraction of the overall grapes being used for wine production in the state. Despite the lack of vineyards, the Hill Country AVA represents the truest "wine country" in the state, in the cultural sense, wherein visitors have the chance to taste and visit the wineries where production occurs, while the High Plains AVA is more focused on winegrape growing versus winemaking.

Through a mixed method approach, this research explores the geography of wine production in Texas, taking into account the environmental, economic, and social differences (the pillars of sustainability) between the predominant grape growing regions versus the leading wine producing regions. Using the *fermented landscapes* framework, the current "state of wine" in Texas is pieced together by exploring how the state's physical and cultural landscapes are being transformed and the ripple effect those changes have on sustainable development. Texas carves out a unique wine identity and strengthens its place in wider wine culture. New methods and education are being used to overcome obstacles the Texas wine industry faces to produce high quality wine (Williams, 2020). This period of transition takes the Texas wine industry as a whole to the next level when compared to established wine regions like California or Oregon.

I. THE WINE INDUSTRY IN TEXAS

Introduction

When most people think of wine in America, they often associate it with wineries and vineyards in California, as California is the current leader of wine production and consumption in the United States (Vine Pair, 2019). However, this was not always the case; California has come a long way in terms of its reputation for wine. Since the Judgement of Paris, a notorious wine competition wherein California winemakers introduced themselves to the world, the wine industry has grown and evolved in North America and now produces some of the best wines in the world (Taber, 2006). Texas became a player in the industry just as California wine was beginning to take off. Since then, Texas has become the fifth largest wine producing state in North America. Nonetheless, Texas wines still do not receive the same recognition as those from California.

Notoriety (or lack of it) notwithstanding, Texas has played a role in the American wine industry for centuries, dating back to when the Spanish began to settle in Texas and needed wine for communion (Thompson, 2016). Even though Texas is home to the first vineyard in America (Thompson, 2016), the current state of tourism and culture of wineries has been a more recent development. When growers in Texas decided to switch from more traditional crops like corn and cotton to grapevines, they began planting varietals that were largely unsuitable for the growing conditions in Texas, like Cabernet Sauvignon and Chardonnay, because these were wine names that growers and consumers were familiar with (Schiessl, 2017). While grower intentions were optimistic, the reality was the production of low-quality fruit and poor wines. Nevertheless, Texas has a

competitive edge on other wine producing states in that it has multiple attributes needed to thrive. Major geographic components such as soil, water resources, and climate are similar to more well-known wine producing regions in Southern France and Italy (Brogan, 2016). But, until recently, growers and winemakers in the state lacked the knowledge to plant suitable varieties until tools and resources to aid in education outreach (in the forms of certification programs, online webinars, and industry related conferences) became more available and critical for success.

The modern Texas wine industry had a slow start until 2005, when Texas Governor Rick Perry signed Senate Bill 877 that allowed wineries to sell directly to consumers, a change which catalyzed rapid growth of the industry. The number of wineries went from just under 100 wineries in 2005 to about 400 (and counting) by 2017 (Wine America, 2018). By exploring the cultural and physical transformation of these *fermented landscapes* (Myles, 2020) in Texas, focusing on the High Plains and Hill Country areas, we can gain a better understanding of the sprawl of effects this agriculture shift has had across Texas and assess its sustainability.

Texas is known for many things - but wine is not (yet) one of them. Wine associations and organizations within the Texas wine industry have partnered up with tourist destinations to promote festivals and events that advocate for Texas wines. This consumer outreach has supported an increase in wines in the Texas market by bringing something unfamiliar to a consumer rather than leaving the consumer gambling on the unknown when making a wine purchase or booking a wine destination trip. Each year these events have been proven a successful model, as they reliably sell out, thus driving new and returning consumers towards Texas wines. Wineries have continued to expand

and grow in the Hill Country over the past several decades, a growth trajectory that has not slowed down (Chalk, 2020).

Figure 1. *An advertisement for the Texas Hill Country Wineries Association event. (sourced from texaswinetrail.com/events)*

Actors in the Texas wine industry have recently been able to change opinions of consumers around the world, convincing them that the wines produced in Texas are as good as the hype and not just part of a tourist trap. As one Forbes writer said, "Despite these obstacles, the industry's 'moment' continues with gusto" (Williams, 2020). However, the majority of Texas wine (95%) continues to be consumed within the state (Thompson, 2016). Winemakers from around the world have looked down on Texas wines, however, at the 2019 International Wine Competition (hosted in Buda, TX) a Master of Wine passed judgement on Texas wines. Though judges had warned that fellow group members would likely not be drinking anything from Texas as they visited the area, Master of Wine John Salvi (the 19th Master of Wine in the world) tried the

unfamiliar Texas wines and claimed they were the best wines he had all week (Chalk, 2020). The Texas wine industry is not only growing in size, but also in the number of quality wines on the market.

There has been a cultural and environmental evolution in Texas that is the direct result of the growth and development of all aspects of the wine industry within the state. Utilizing the *fermented landscapes* framework (Myles, 2020), which is concerned with how landscapes, both environmental and cultural, are transformed by various processes of fermentation, this research seeks to better understand how and why the wine industry is the way it is in Texas, asking: *What is the current status of the Texas wine industry and how has it shaped the culture and environment of the High Plains and Hill Country areas in Texas?*

Study Area

There are eight American Viticulture Areas (AVAs) total in the state of Texas, which has about 4,500 acres of vineyards planted (as of 2017). Of that total, 2,700 acres (the majority) are in the High Plains and only 800 acres are in the Hill Country. The

Figure 2. *Wine Growing Regions of Texas map with major cities nearby (Sourced from gotexanwine.org).*

Texas High Plains region is in North Texas and shares a border with New Mexico (to the west) and below the south/west of the Oklahoma border. The largest urban hub of this region is Lubbock, a college (Texas Tech University) and farming town with a population of approximately 260,000.

The High Plains have sandy soils which make it easier to grow agricultural crops. The Hill Country region is made up of rocky terrain and rolling hills with rivers flowing through them. It is closely located to urban areas, such as Austin and San Antonio, where visitors can take a day trip to visit or spend days close to home and indulge in a variety of activities appropriate for all demographics. At present, some vineyards have operating wineries, but not all do. Similarly, while some wineries in the area have vineyards on site, they are often referred to as "show vineyards," vineyards which are cultivated mainly for the consumer's benefit, perhaps even to make customers feel like the winery grows their own grapes - even if they do not. Indeed, many Hill Country wineries use contracts with (High Plains) growers, who do not produce wines for themselves, to obtain their grapes for winemaking in lieu of having their own vineyards on site. Wineries who do not have vineyards can focus solely on wine production and tasting room operations.

Sustainability and Wine Production

Sustainability can only be achieved when all three pillars of sustainability - environment, economics, and social equity - are balanced. One pillar cannot be satisfied without equally satisfying the others because the pillars work simultaneously together to protect the environment, preserve economic growth and development, and promote social equity (Portney, 2015). Sustainability, or sustainable development, meets the needs of the present without compromising the ability of future generations to meet their own needs

(United Nations, 2020). As the rapid growth of the wine industry is examined, it is critical to consider these aspects of sustainability in this study as individual industries should be doing their part to work towards global goals.

The environmental pillar of sustainability is equally important as the social and economic pillars, though environmental side effects of development are often neglected. The environmental pillar is made up of more than just plants and wildlife, but also energy used, biodiversity, and water quality (Stenzel, 2009). The social aspects include community impacts, poverty, and human rights (Stenzel, 2009). The economic pillar is important because of the amount of jobs created, profits, and return on investments are some of the areas that support the economic pillar (Stenzel, 2009). Each pillar plays a vital role for the future of the Texas wine industry.

The needs of food production, including grapes for winemaking, should not compromise the biodiversity of other ecosystems. The intrinsic value of plants can provide food for our needs as agriculture products, but also exacerbate the depletion of soil nutrients. A variety of sustainable farming practices can be used in vineyards to increase their beneficial environmental impacts, including promoting biodiversity, being organic, and reducing waste by composting production materials from the winery. Specifically, using a wholistic approach such as permaculture, can lead to soil improvement and reduces the amount of nutrient depletion of the soil in vineyards. Also, the needs of a vineyard are labor intensive and, in some cases, cannot be replaced with machines. This creates jobs as labor is needed to manage the vineyard while minimizing the carbon footprint and negative outputs of agriculture crops. In comparison to other crops, implementing sustainable practices in vineyards does not add a financial burden

since manual labor is already required; vineyard managers need "only" adapt their practices towards these more sustainable options. As the Texas wine industry continues to grow, more sustainable practices can be implemented.

Research Purpose

The purpose of this research is to identify the major environmental and cultural components of the two largest AVAs in Texas. When comparing these two AVAs, the High Plains and Hill Country, several differences emerge. The High Plains AVA, which is located in a region historically known for cattle ranching and monocrop agriculture, produces the majority of the grapes for wine production, but lacks the overall social and economic infrastructure needed to become a successful wine tourism industry (Overton, 2020). In contrast, the Hill Country AVA, which has significantly fewer vineyards, satisfies the needs for wine tourists, given its close proximity to larger urban areas (like Austin, San Antonio, and Houston) and a variety of other recreational activities (such as shopping, outdoor activities or historic attractions) but does not yield enough grapes to supply the wineries nearby.

By studying the relationships of these two AVAs, the extent of their interactions can be analyzed on multiple levels. Identifying the issues and strengths of each region will help identify core themes the Texas wine industry has seen over the past decade when it comes to the growing wine industry. Because the wine industry has a significant economic impact on the economy, contributing $13.1 billion dollars annually in Texas alone (Dunham & Associates, 2017), this research will identify some of the key factors that contribute to the Texas economy. Further, this research will examine the cultural changes underway as well.

II. LITERATURE REVIEW

History

Texas is often overlooked when it comes to wine production and consumption yet played such a vital role in the survival of the wine industry. Thomas V. Munson, a Texan and prominent historical figure in the wine industry is widely considered the "father of Texas grape culture." Munson worked with both native and cultivated grapes to adapt them to the warm southern United States (Perry and Bowen, 1974) and is known for creating an American (Texas) hybrid grape varietal that was resistant to the Phylloxera disease outbreak that wiped out vineyards in Europe in the late 19th century. This was one of the first major innovations that viticulture has seen and is why this would be an interesting place to start a timeline of important events for Texas.

Texas has more indigenous grape species than any other location on Earth, including fifteen (of thirty-six) species of the genus *Vitis* (Johnson and Robinson, 2007). Before the arrival of Europeans, indigenous peoples harvested and consumed these grapes, which grew in many parts of Texas, particularly near rivers and streams where the native vines climbed the trees of landscape (McEachern, 2003, Kane, 2012).

Even though the Volstead Act, commonly known as *Prohibition*, put a major halt to the growing wine industry at the time (Kane, 2012), Val Verde Winery, located in the city of Del Rio on the United States-Mexico border, remained open. Val Verde Winery was founded in 1883, remains open to this day (Kamas et al. 2008). Founded by Italian immigrants, sustained itself by selling grapes and making communion wines for the church (Kane, 2012). Even today, the last vestiges of prohibition are still present - as of

2018, Texas had five counties where the sale of alcohol remains illegal (Marks, 2018). Hays County, the eastern wing of the Hill Country AVA, was a dry county until 2005.

Texas had to overcome many learning curves when farmers began to plant vines. It was not until the 1970s when researchers at major Texas universities (Texas A&M University, Texas Tech University, and the University of Texas) began to experiment with test vineyards, finding that mostly French-American hybrids could grow successfully in the warm and arid regions of Texas. Vineyards in west Texas provided a source of funding for the University of Texas in the mid-1980s when profits from university's oil and gas holdings were low (Cunningham, 1985).

Tourism

Even though Texas has "perfect growing conditions for varietals better known in central Italy and France's Rhone Valley…winemaking is a relatively new venture" and can be proven as the varietals planted were grapes that do well in California, not Italy or France, and was deemed unsuccessful (Brogan, 2016). However, behind Napa Valley, the Hill Country AVA is the second most visited wine destination in North America and ranks in top ten in the world (Brogan, 2016). It was not always that way, however; in earlier years (and even still, but to a lesser degree), the Hill Country attracted visitors for peaches, shopping, and the history of Fredericksburg (Fredericksburg Tourism Report, 2017). Nowadays, the greatest lure for many tourists is the flourishing wine country

found in the Hill Country, making the wineries in the area one of the top attractions for the area (Fredericksburg Tourism Report, 2017).

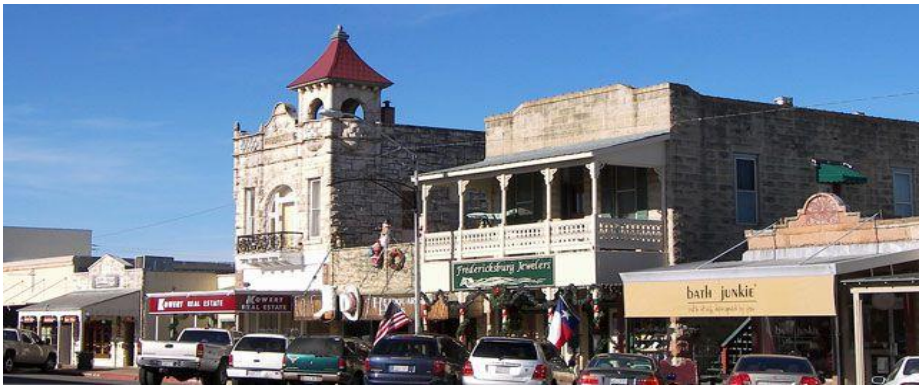

Figure 3. *Main Street in Fredericksburg Texas. This showcases some of the historic charm (sourced from https://www.tourtexas.com/destinations/fredericksburg).*

In 2020 the wine industry, globally, took a large economic hit due to the COVID-19 pandemic. Wine production in Texas was deemed an essential operation because wineries are agricultural producers. The closure of tasting rooms however, beginning in March of 2020, created a significant loss of revenue that forced wineries to lay off a large portion of their staff members. Wine America released a survey to all the wineries in America and received feedback from about ten percent of the total wineries. The survey found that wineries would be laying off about 4,500 employees total by the end of March and that was only representing a small sample of the total number of wineries (Good, 2020). This survey shows the impacts the presence tourism has for the success of wineries by helping to create and secure jobs while also boosting the economy. The survey also predicted that “the average winery will lose $37,376” in loss of sales and unexpended expenses (sanitizers, cleaning products, and additional services that are not needed for normal operations) (Good, 2020).

Wineries heavily rely on Spring-time revenue made in the tasting room to cover the costs of their employees and grape purchases through for the duration of the year. Tasting room closures due to COVID-19 shows the importance of the relationships wineries and growers have with each other and the impacts they have on their communities, both economically and socially. As one winery owner put it in an interview with the Houston Chronicle, "Texas wineries are agricultural businesses with lots of farmer families depending on our viability…every day we are closed is detrimental to the economic survival of (thousands) in farming and many more in associated businesses" (Robertson, 2020).

Sustainability of Vineyards and Risks

The significance of agricultural inputs and outputs in comparison to vineyard inputs and outputs help to identify the sustainable benefits vineyards offer as well as the environmental changes taking place. Water use and land management are important components of this change. Too much industrial growth, of the wineries and production facilities, into an area could pose "future challenges (that) could include non-point source pollution, unsustainable surface and groundwater withdrawal, a loss of plant and animal diversity and drastically altered fire regimes" (The Nature Conservatory, 2019). There are periods of drought, which would add stress on the aquifer for a water supply. Plant root structures help infiltrate the bedrock specifically in the Hill Country AVA allowing for water penetration into groundwater systems (Woodruff and Wilding, 2008). However, human interaction and overgrazing have disrupted some of the natural environments. As the Texas wine industry grows, it's detriment to the environment should be analyzed and reduced, as possible.

The amount of water used for many types of agricultural crops (like cotton) adds stresses on water resources for Texas, specifically in the High Plains region. From an environmental perspective, vineyards are a more sustainable alternative. Vines require (relatively little) irrigation only a few months out of the year, during late spring and into the summer (Wrede, 2010). Horticulture crops such as grapevines need heavier rains in the spring time to produce crops in the fall which decreases the need for year-round irrigation (Wrede, 2010). A vine can tolerate the high summer temperatures with little increase in watering and still produce a good crop yield because they are drought tolerant.

After harvest, which typically ends mid-October, the vines will go through a state of dormancy through early spring. This leaves a large window during the year for native grasses and plants to grow with hardly any interference or competition, maintenance, or fertilization. In areas like the High Plains, cover crops help to reduce agricultural runoff and can minimize fertilizer usage. In shallow soils, such as the soil in the Hill Country, invasive Ashe Juniper trees (commonly known as “cedar”) limit the growth of grasses underneath and extends past the edge of mature tree canopies (Lyons et al, 2009). This reduces soil infiltration (LCRA, 2000) and increases water runoff thus disrupting the hydrologic cycle (Hill Country Alliance, 2015).In comparison, vines do not limit grasses or cover crops growing nearby and do not compete for water or nutrients. Thus, having vineyards in both areas of Texas has had positive environmental impacts.

A major source of water in the Hill Country is the Pedernales River. Because the Pedernales River runs directly through the Hill Country AVA, it should be considered when examining the environmental pillar of sustainability. The Pedernales Watershed is located west of Austin in Central Texas and spans through five counties sitting atop the

Edwards-Trinity Aquifer, creating a more environmentally-sensitive area (LCRA, 2000). The Pedernales River is spring fed providing cool, clear water starting far west of the watershed in Kimble County and running east (towards Austin), spanning over 100 miles, before meeting with the Colorado River in Lake Travis (McCord, 2015). This makes the river enjoyable and desirable to those who want to use it for recreation purposes and runs parallel with Highway 290, the main corridor for wineries, breweries, and distilleries. With the amount of wine industry-related growth that has occurred in the Hill Country, the data recorded for the Pedernales Watershed shows that there have been no major changes in climate or discharge data other than occasional flooding and droughts. On average, the percent of annual rainfall that ends up as runoff is almost 33 percent. This is a large sum of water runoff that leads to rapid flooding in the area, such as the more recent flood in October of 2018, and could be decreased with better land management practices (McCord, 2015).

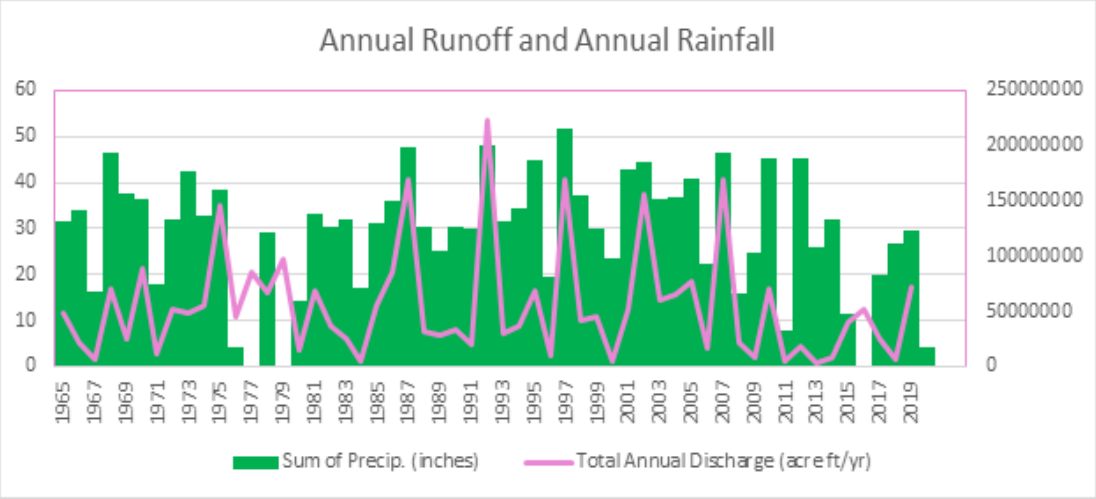

Figure 4. *The Annual Runoff and Annual Rainfall. Data pulled from U.S. Geological Survey (USGS) site. 32.9% of annual rainfall ends up as river runoff in the Pedernales Watershed.*

In Texas, the industry has, over time, taken itself more seriously and focused on more savvy measures to make a better product overall – and one that has a more environmentally-friendly approach. The industry has shifted focus to what makes a higher quality grapeand the wine itself without leaving any of the variables in-between out. Vineyard management practices, such as cane pruning and shoot thinning, and modern winemaking practices that utilize less agents being added to the wines help to improve the overall quality of the wine. As one winery owner would say, "New methods of winemaking—new vineyard and winemaking technology—and varietal experiments are happening at every level of the industry" and, further, I would argue, increasingly considers the sustainability implications for the future of the industry (Williams, 2020).

Figure 5. *An example of the impacts of over-spraying on nearby crops. This is a winegrape vine. Photo by Kourtney Collins.*

Once a vineyard is established, there are still unforeseen problems in agriculture that can occur. Growers in the High Plains have watched a vineyard suffer as the vines become crippled and die. This issue has been seen in many of the vineyards in Texas with very little explanation or action taken to resolve the matter (Kennedy, 2018). Herbicides used on other large agricultural crops get sprayed at high volumes, and High Plains growers, located in a windy area, often run into the effects of those herbicides drifting onto nearby vineyards. Herbicide drift was not a big issue for vineyards until the old herbicides methods no longer worked (because of resistance), which led to commercial crop growers to shift to herbicide formulas with 2,4D and Dicamba, which are more likely to cause drift due their application procedures. While there are regulations and permits to spraying these new herbicides, they are unrealistic and "fairy-tale" like, according to one vineyard grower, which means those using them do not always comply with the guidelines (Kennedy, 2018).

While there are vineyards across Texas, "Pierce's disease is the #1 limiting factor to the production of grapes in Texas" (Appel et al. 2010), and vineyards in the Hill Country are more susceptible to the disease which makes it harder for wineries in the area to grow their own fruit or to buy it. In the High Plains, where the majority of vineyards in Texas are, the risk of Pierce's disease is lower. However, other risks such as hail and early winter freezes are much higher compared to the Hill Country. The humidity in the Hill Country adds to the disease pressures and pests but is overall better off than areas further east.

Shaping an Identity

The geographical specification of wines, or Wine Origins, based on the soils, terrain, and climate of wine regions is a common way to help capture characteristics found in the wine used across the globe (Wine Origins, 2020). One of the many organizations in the Texas wine industry, TWG (Texas Wine Growers, 2020) declares: "Our mission is to promote and protect the integrity of Texas Wine by making wines solely from grapes grown in the terroir of Texas."

Regulations, like the ones implemented for its members by TWG, helps to reveal the "truth in labeling" that increases consumer awareness of product sourcing (Meewes, 2017). When Texas first made wine, it was very hard to produce 100% Texas wines because vineyard yields were often low or unpredictable. As wineries began to see a steadier stream of revenue, mainly through wine club memberships, the need for labeling regulation became more of a priority as the wines were becoming more widely available. Wine Club memberships help produce revenue that can be counted on even in unpredictable times, such as the COVID-19 pandemic. However, this distribution model was not viable until 2005 when a bill was passed in Texas that allowed wineries to ship wines directly to consumers (Fauchald, 2005), which facilitated regular wine shipments to consumers from their favorite wineries.

An increase in land values has also coincided with the increase of the wine industry. Along Highway 290, in the Hill Country, "in 2014 it was $40,000/acre. That acre is now $100,000-$120,000" (Chalk, 2020), which demonstrates the demand for prime real estate in the area but also why starting a vineyard in the Hill Country demands greater investment. Questions arise for investors such as: If vineyards were planted in the

Hill Country, how many years would it take to pay off associated costs with the land and vineyard? Or, how much more would the fruit cost, and then the bottle cost for the consumer, if more vineyards were planted in the Hill Country? This is an important factor to recognize as the winery-grower relationship leans on each other because the land to plant vineyards significantly drives the cost up for Hill Country wineries who consider planting vineyards where the winery is when the economic resolution is to depend on High Plains vineyards.

III. RESEARCH METHODS

Methods

Being a part of the Texas wine industry for over four years, I composed a list of industry members and their qualifications to determine who should be interviewed and at what priority level. By ranking them, I was able to pick interviewee candidates based on well-rounded overall knowledge of the wine industry to endeavor to minimize bias. Seven interviews were conducted with these key informants in the industry in the study regions, including growers, winery owners, and wine educators who have been involved with the Texas wine industry over the last decade or longer to get a sense of how it has changed. As an insider, I was able to conduct the interviews as a colleague and peer, making the interviewees feel more comfortable, since the terminology and language flowed smoothly, allowing our guided, but unstructured, conversations to dig deeper into the research topics. Having a diverse mix of interviewees gave a better perspective of major moments Texas has seen, its ripple effect from the vineyard, and the path a grape will take to get into a consumer's glass. Because each interviewee came from a different background, I conducted unstructured interviews, guided by a set of questions to focus on the changes, both good and bad, that have occurred in the last decade. I geared each interview towards each of the interviewees' individual areas of expertise.

The interviews, which were conducted and recorded via Zoom, helped reveal the behind-the-scenes logistics through qualitative analysis to make the final product, wine, because the two areas under study rely on each other even though they are geographically far apart. Interviewees were asked to shed light on the steps taken to be successful and how the interviewees' business or role has evolved over the last decade. The interview

responses helped frame the identity of Texas wine and why buying fruit, even when in a different AVA, is a critical part of Texas wine. As an industry insider, I know that some wines made in Texas and labeled as a "Texas wine," though they may not truly be a 100% Texas wine. However, it is also clear from doing background research that, in the early stages of commercial wine making in Texas, the only way to make enough wine to sell was by sourcing fruit and juice from other states. Questions for interviewees further examined how that has changed over time and helped to identify necessities, like labor and equipment, that play a role in production.

Before conducting the interviews, a thorough literature review was organized to create a timeline for Texas viticulture and winemaking and to provide a reference for discussion during the interviews, such as the major transitions that have occurred in Texas viticulture and winemaking. This analysis of primary documents was essential for building a comparison of major points of growth within the industry over time as well as supplying information regarding its sustainable impacts. The literature also provided a better understanding of the different disease pressures and pests for each area and understanding the significance each area must overcome to better explain the lack of vineyards in the Hill Country and why the High Plains has significantly more in comparison.

Limitations

As this research was conducted during the summer months in 2020, it was impacted by the global pandemic of COVID-19. Due to the pandemic, safety precautions were in place to minimize the spread of COVID-19. The interviews were conducted through online webcam software. Since the interviews were telemediated, proactive

social cues (like body language, eye contact, and tone) were negatively impacted. In addition, interviewees were often interviewed while they inhabited rural areas with relatively slower internet capabilities, which sometimes caused interruptions during the discussion, further challenging my ability to establish a good interview-interviewee rapport.

The time frame in which the interviews were conducted was during the summer, which is also the busiest time of the year for winemakers and growers. Harvest season during a normal year would have been a great opportunity to capture the relationship of Hill Country and High Plains industry members through in person interviews, however, due to the COVID-19 pandemic it was not ideal. I do feel that information collected through interviews was sufficient enough to understand the culture and relationships from my experience over the years. And, by utilizing online tools to conduct interviews, I was able to be more flexibility in the event something unpredictable happened. However, the ability to conduct in-person interviews, in the vineyards or production facilities ,would have likely resulted in more interviews being conducted as technology devices (like computers) became hinderance.

IV. RESULTS

This research examined the overall status of the wine industry in Texas, the evolution of how it got to its present status, and the cultural components of the industry. Even though it is the fourth largest wine producing state in the United States, there is a relative lack of recognition for Texas wine in comparison to other well-known regions like California and Oregon. The identity of Texas wine has been shaped over the last decade, and significantly more so in recent years; this research provides insights as to why that is. The current status, or "state of wine", in Texas was explored, and how the physical and cultural landscapes have been transformed by these *fermented landscapes*, ultimately revealing how Texas carves out its unique wine identity and strengthens its place in the wine culture of the United States.

Areas Studied - Opportunities for Sustainable Solutions

In terms of viticulture, planting vineyards in the Hill Country offers a range of environmental benefits. For example, if the area is covered in Ashe juniper (colloquially known as "cedar") vegetation, in order to plant a vineyard, a large portion of trees must be cleared. This might be seen as undesirable except that Ashe juniper, although a native species, is a known environmental detriment in the Hill Country, a rather thirsty, invasive plant with a large canopy cover, which disrupts the percolation of rainfall into the ground and inhibits the growth of native grasses (Lyons et al. 2009). However, given the life cycle of grapes, clearing the land of this kind of vegetation and replacing it with grapevines, paves the way for the regrow of native grasses within the vineyard. Specifically, after harvest, when all the grapes have been picked, grapevines go dormant

through early spring, leaving a large window during the year for other plants to flourish (Wrede, 2010). Native grasses and other plants can grow between the vine rows with hardly any interference or competition. The added benefit of soil stabilization from the native grasses also means minimal agricultural runoff (Wrede, 2010). Thus, an increase of vineyards in the Hill Country, insofar as they replace Ashe juniper vegetation, would facilitate at least a partial restoration of grassland species that was otherwise prohibited. Vineyards thus serve a useful purpose in terms of commodity production as well as providing (agricultural) greenspace and serving an impetus to remove Ashe juniper vegetation.

Although there are vineyards in the Hill Country, they come at a price. Land values are significantly higher in the Hill Country now than they were just a decade ago. In addition to rapidly rising land values, which increase the cost of production due to increased rent or purchase prices, the cost of planting a vineyard in the Hill Country is also higher than elsewhere in the state due to the presence of rocky (limestone or granitic) soils, which necessitate the use of additional equipment for planting in order to properly plant the vines. Further, “Pierce's disease is the #1 limiting factor to the production of grapes in Texas” (Appel et al. 2010), and vineyards in the Hill Country are more susceptible to the disease, which increases financial risk for vineyard growers.

In the High Plains, where the winegrapes of Texas are predominantly grown, there is a mix of various types of agriculture in place. There is a large cattle industry, a large agriculture university, and large-scale crop production (of crops such as corn, cotton, and sorghum) that has shaped the culture in the region. Many farmers in the High Plains area, prior to growing grapes, were in some way tied to agriculture, and as the

wine industry grew, some farmers in the High Plains switched from large-scale commodity crops to vineyards. An interview with a High Plains revealed that, upon taking his first harvest to a local winery to sell:

> "We set it all out and he weighed it. It wasn't very much, but he wrote me out a check for $800 and I just kind of dropped my teeth. And I told [my wife] on the way home, if that would've been cotton, that would've been eighty cents worth of cotton. You know, that was a huge eye opener for me, how [the] value [of] crops differ from low crops, and I knew then I wanted to get into that for sure." (High Plains Grower A, personal interview, Sept. 7, 2020).

For him, grape growing has alleviated the stresses of growing cotton, for example, that need a constant supply of water and year-round attention for a lower return on investment.

The High Plains growing region is significantly different from the Hill Country, due to a number of different geographic elements. This region is windy, dry, and flat with deep, red, sandy soils and an aquifer-based water supply. In addition, mechanized vineyard management in the High Plains overall is easier than in the Hill Country. Growers can more often utilize farm equipment because the landscape is considerably flatter and the ability to grow higher yield crops on more acreage is typical. In the Hill Country, the topographical variation and dissected bedrock make it much more difficult to use certain types of farming machinery and therefore, the vineyards tend to be smaller. Harvesters and pruning machines cut labor costs in the vineyards, but come with a large initial price tag. For a larger vineyard in the High Plains, it would take just a few years to pay off these machines versus the Hill Country, where it could take over a decade due to the limitations of volume and vineyard sizes.

Weather conditions - and more specifically, how to mitigate the hazards associated with these conditions - are also significantly different between the two areas. One High Plains grower said of this difference:

> "It's different kinds of weather, [like] early freeze issues in our weather, but not extended wet spells like [they have] in the Hill Country. Our storms come through, and are gone in a couple hours...Our problems are very similar [here and there] - they're pretty much all weather-induced - but it's very different weather [in each place]." (High Plains Grower A, personal interview, Sept. 7, 2020).

Although both areas can be negatively impacted, the possibilities for responding to weather-related challenges vary. For example, although the High Plains can get unpredictable weather, there are tools available to combat the weather-related challenges; growers can utilize (costly, but effective) machines and techniques to save a crop when needed. Similar to the situation regarding machine harvesters and pruners (i.e., that their cost may not justify their utility in the Hill Country), the use of protective equipment in vineyards in the Hill Country would not be economically feasible given the average size of a vineyard. Even if the use of the equipment available made financial sense, Hill Country growers are impacted by a different set of weather challenges (such as higher humidity, hotter temperatures, and flash flooding) that are not as easily countered by the use of equipment.

Despite the unique set of obstacles associated with viticulture in the High Plains, in a typical year, the crop yields will be higher and less expensive to cultivate in comparison to the Hill Country. Thus, there is a greater availability of grapes from this AVA in comparison to other areas in the state. However, when it comes to wine production and selling wines, the Hill Country is better suited because of its proximity to Austin and San Antonio, well established hospitality and tourism services, and retail

spaces. Some growers also make their own wines but do not sell at their onsite facilities. In the High Plains, "you have an ideal climate for growing grapes, but the problem is: there's a tourist behind every tree. And obviously there are no trees [here]. So, the retail side of the business needs to be down where all the bustling population is at…that's why we ended up down there" (High Plains Grower A, personal interview, Sept. 7, 2020). Being exposed to a number of growers within the industry, it can be generalized that most tasting room operations for High Plains growers are better suited in the Hill Country due to the high volume of customers. The numerous recreational opportunities (hiking, hunting, fishing, and shopping, to name a few) and its natural beauty adds to the overall culture for the wineries in the Hill Country, unlike the flat and desolate landscapes of the High Plains.

The constraints faced by Hill Country growers, even if they have access to greater opportunities for tourism and consumer attention, heavily depend on High Plains growers for fruit, allowing wine-based businesses and operations to flourish in both locales. There is a disproportionate number of vineyards in the area if you look from the perspective of the number of wineries present, and the opposite is true in Hill Country -- there are far more wineries than you would expect based on the scale of growing there. As one winery owner in the Hill Country put it:

> "Our whites program is entirely dependent on the High Plains. There's not enough [fruit] to source from down here. So many of the vineyards [in the Hill Country] are small...and are...contracted with one winery, and then no one else can get that fruit. Where[as] in the High Plains, with those huge growers, you [even] get parts of their vineyards, with multiple contracts going on and you can trade with other wineries depending on their needs. There is much more of a market [for grapes] up there."
> (Winery Owner A, personal interview, Aug. 12, 2020).

In sum, the High Plains has larger vineyards and a greater capacity to support a wider array of wine grapes, like white wine grapes and other cooler-climate grapes (e.g., Cabernet Franc and Semillon) which do not tolerate the Hill Country's growing conditions.

Even though the High Plains fruit is up to par, not all wine makers in the state prefer High Plains fruit. The variations between the Hill Country and High Plains AVAs are distinct enough to facilitate preferences between them. Some winemakers may prefer wine attributes emerging from grapes grown in other regions of Texas (Winery Owner B, personal interview, Aug. 11, 2020). Or having the opportunity to blend the grapes of both AVAs as the winemaker sees fit to create a more balanced wine. The presence of refined and sophisticated preferences of this kind are a clear sign of the industry's development.

Overcoming Pierce's Disease

The industry in Texas has experienced exponential growth in the last three decades. In 1975, Texas was home to only one commercial winery (Morse, 1990) and, in 2008, there were just over 200 (Texas Department of Agriculture, 2008). Today, Texas is home to more than 600 (TABC, 2020). The major viticulture areas in Texas are located near Lubbock, Fredericksburg, Fort Worth, and Fort Stockton. These areas are considered to be at a lower risk of Pierce's Disease, a plant disease prevalent throughout the state, but they all vary in susceptibility due to location within the state. Pierce's Disease is arguably the largest source of disease pressure to grapes which is caused by a bacterium, *Xylella fastidiosa*, and is transmitted to vines by insect vectors, primarily the Glassy-winged Sharpshooter. The disease has been known to cause significant losses in many Texas vineyards (Kamas 2000, Townsend, 2012). High humidity (a common weather element in

central, east, and south Texas) or proximity to a body of water can increase the vines exposure. Cooler temperatures, higher elevations, and aridity are natural geographic factors to help minimize the disease exposure.

Pierce's disease presents many challenges that cannot be controlled, industry members were committed to grape growing in the state and took action by diving into intensive research to find the causes of the disease, how it spreads, and how to stop it. Although securing funding for the research was no easy task, researchers report: "In the last decade we have made enormous scientific strides in our understanding of the disease and in our prevention of its spread" (Appel et al. 2010). These findings help to provide access to education and guide vineyard establishment by offering guidance in terms of what to plant and where, and how vineyards should be managed so that the disease can be mitigated. There are other disease pressures vineyards are exposed to, such as powdery mildew, but there are good products and solutions on the market to help manage them.

Today, growers, winemakers, and winery owners all come from diverse backgrounds. Some grew up in farming communities and have extensive experience in agriculture, often growing crops other than grapes. For others, the wine business is a second career. Current and former bankers, attorneys, doctors, pharmacists, engineers, information technology professionals, and retired members of the military are making names for themselves in the Texas wine industry (Townsend, 2012). "Texas wine" has become a term that encompasses a wide range of different business types, from viticulture and winemaking, to restaurants, events, and tourism (Esco, 2009). Texas wine has come a long way.

Texas Consumers

Figure 6*. Carl Money (left), is the President of the Texas Wine Growers. He presents 100% Texas wine to a group of consumers who are attendees at the Wine Tasting Series event featuring single vineyard and varietal wines. This event was a sold-out event that was held in February of 2020. Photo by Miguel Lecuona, Hill Country Light Photography, 2020.*

As the wine industry has become more mature so have its consumers. Early consumers were poorly educated about wine varietals, other than what was being grown in California. As one winery owner put it: “In 2013, at a wine and food festival, you had people who did the tasting part [of the event] who would dismiss Texas wine without even tasting it. 2014 was the tipping point, where[in] people had become warmed to Texas wines” (Winery Owner A, personal interview, Aug. 12, 2020). An important development has been the acceptance of lesser-known wine varietals. Although the varieties being introduced to the market in Texas - like Tannat and Mourvedre - are not new, they are less familiar to consumers than some other grape types, which means producers need to focus on bridging the gap with consumers. This will continue to be one of the most important challenges Texas winemakers will need to overcome as they

attempt to expand into larger markets. For example, as someone who has worked in tasting rooms over the past several years, there has been a shift in terms of what consumers are asking for; increasingly, they wanting to know more about specific varietals, which is a change from when I first entered into the Texas wine industry.

Marketing challenges aside, these otherwise under-represented wine types allow Texas winemakers to create blends that capture all the grape phenolics a winemaker most often desires. The winemakers can build flavor profiles that complement each other, especially when drawing from grapes grown across the large state of Texas versus only working within a single AVA. As the quality of the product produced in the state has improved, Texas wines have begun to be accepted into out-of-state markets. Texas wineries have created "really good relationships with the som [Sommelier] community. In general, we have seen a lot of support from the som community…from all over the world" (Winery Owner A, personal interview, Aug. 12, 2020). Regardless of the fact that Texas wine remains largely undiscovered by consumers in other U.S. states and countries, Texans seem to be sold, so to speak, and their purchases are enough to allow Texas to rival the top wine producing and consuming states in the country. "Texans have this pride for Texas based products will tend to value that more when it comes to making a purchase" (Winery Owner A, personal interview, Aug. 12, 2020).

Figure 7*. Fellow Texan drinks Texas wines. She supports Texas wine while wearing Texas bandana. Photo Taken by Kourtney Collins, in the tasting room at a winery in the Hill Country, May 2020.*

Texas consumers have come a long way in terms of their wine demands, and wine producers have been able to meet those demands with higher quality wines. Though, it seems there is a generational element to these changes; as one wine educator (Wine Educator A, personal interview, Aug. 12, 2020) put it, the younger generations are "willing to try anything" while the "older generation is unwilling to change." For example, industry professionals have come to understand that if their customers want a California cabernet, they may be disappointed to find that cabernet does not grow in Texas like it does in California. However, Texas wineries have alternatives that are similar in style which, although perhaps unfamiliar, will nevertheless offer a high-quality tasting experience (paraphrased from Winery Owner B, personal interview, Aug. 11,

2020). This dynamic adds to the complexity of Texas wine. Those in the industry have had to grow and adapt production to meet consumer preferences; growers and winemakers have had to identify grapes that "meet the growing conditions of Texas," which is itself "an ever-evolving process," as well as help themselves – and their customers – to understand "what's right for them in terms of their tasting profile" (Winery Owner B, personal interview, Aug. 11, 2020).

Role of Tourism

Examining people and how they respond to and interact with tourism is important since tourism helps shape the wine industry in Texas and can give growers alternative options for cultivation without negative economic or social effects. Ecotourism is "a unique tourism form that has become very popular due to the greening of markets" and the wine industry can accommodate into being an ecotourism industry while also being sustainable (Bjork, 2000). Tourists can visit wineries with a clear conscience as the environmental pillar of sustainability can be supported by the presence of vineyards near the wineries because tourists are wanting to feel the authenticity of wineries, and vineyards give them a sense of that (Myles, 2020). When a tourist goes to a winery, the "farm to table" mindset is present and leads to the expectation to have a vineyard, or farm, on site but that's not always the case. The tourist expects to see vineyards, where they expect product to be sourced from. In the Hill Country, where the bulk of the tourists are, pressure is added to wineries to satisfy consumers' needs and, in turn, the environmental pillar can be rounded out as there are environmental benefits to planting vineyards as discussed above and below.

Winery tourism stimulates the local and regional economy, infusing outside money into the surrounding communities, which can help foster community improvements and bring in visitors to nearby attractions that might not otherwise be frequented. This supports the social equity pillar of sustainability. Fredericksburg, Texas is the main hub of tourism for the Hill Country; people visit for their famous peaches, antiques, and German-heritage charm. The town is known for their unique bed and breakfast establishments and local vendors, which eventually included local wines (Wine Educator B, personal interview, Aug. 12, 2020 and Winery Owner A, personal interview 6:30). Interviews revealed that visitors will remark to winery staff about the southern hospitality and charm on "Hill Country time," when visiting this wine region, and consumers appreciate the smaller winery experience, where every staff member plays a role in both front-of-house and back-of-house operations, and work to educate the consumer, lending authenticity to the product.

Environmental and Growing Realities

The main impetus for transitioning from commodity crops to viticulture stems from a need to conserve water. Traditional crops like corn, sorghum, and cotton flourished for decades in both the Hill Country and High Plains. However, those crops are water intensive, often requiring significant investment in irrigation infrastructure and dependable access to water from aquifers that, in many cases, are in a state of overdraft. Droughts are not uncommon in Texas, and the year 2011 (the most intense one-year drought on record), in particular, was devastating for Texas agriculture and caused many water wells throughout the High Plains and Hill Country to go dry. Access to water is a major limiting factor to the expansion of agriculture in the Texas High Plains (Townsend,

2012). Farmers in the High Plains tap into the Ogallala Aquifer, a water source shared by the "breadbasket" states of Texas, Oklahoma, Kansas, Nebraska, and South Dakota. Farmers in this region, particularly the High Plains, require a profitable crop that can survive even in difficult growing conditions. Grapes will honor those needs.

However, grapevines are more susceptible to fungus, pests, and disease in a humid climate – but humidity is not a problem in the High Plains. Vines are drought tolerant and can handle the heat and aridity, are dormant during the winter, and have deep root systems which help stabilize and secure the vine in the windy conditions of the High Plains. The leaves on the canopy also act as a natural defense against the sun during long summer days as the grapes ripen. The anthocyanins, a type of pigment within the skin of the grapes, also aid in sunburn protection.

The major terroir components of soil, water, and climate in the High Plains and in Hill Country are similar to the well-known wine producing regions of Southern France, Spain, and Italy (Brogan, 2016). Nevertheless, it is the climate of a given place that determines its overall suitability for growing wine grapes. The warm and arid climate conditions in central and west Texas, together with the persistent threat of drought, creates a risk for commodity crops that grapes will do well, and even thrive in these conditions. The annual growth cycle of grapes is such that a vine can tolerate high summer temperatures with little increase in watering and still produce a good crop yield. In Texas, vines do need some irrigation, but only for a few months out of the year during late spring and into the summer (Wrede, 2010). Thus, despite conditions that might be problematic for other crops, Texas may have a competitive edge on other wine producing

states by having multiple desirable environmental attributes that are needed for grapes to thrive.

Since the early 2000s, Texas vineyards have increased in both number of vineyards and the size of vineyards as the desirable characteristics of the Texas environment for growing wine grapes is becoming increasingly recognized. That growth has facilitated an increase in fruit sourcing from Texas by wineries both in Texas and elsewhere. Industry insiders expect this trend to continue as wineries begin to see the value of place-based designations and organizational memberships, which help businesses create distinction in the market. An example of such an organization is the Texas Wine Growers (TWG), an organization that promotes the use of Texas fruit in Texas wine. The geographical specification of wines based on the environmental attributes of their places of origin is a widely accepted model across the globe (Wine Origins, 2020). Thus, TWG (Texas Wine Growers, 2020) believes: "Our mission is to promote and protect the integrity of Texas Wine by making wines solely from grapes grown in the Terroir of Texas." For Texas growers and winemakers to meet the specifications for sourcing and quality that are required by such designations or memberships, some viticulturalists and vintners will need to make adjustments to their production methods (Wine Educator A, personal interview, Aug. 12, 2020).

Winegrape growers are unique in comparison to other agriculturalists. For example, grape growers are growing a product for which quality trumps quantity; in other words, some agricultural practices are used to limit the production in order to improve grape quality, which is itself measured across several dimensions (sweetness, skin thickness, size of fruit, density of fruit, etc.). This is unlike the production of other

agricultural products, in which, generally speaking, a higher yield is almost always better. In addition, the grapes grown may end up with different wineries, who may have differing preferences regarding production techniques and timelines, harvest practices and logistics, and post-harvest processing. As one winery owner (Winery Owner B, personal interview, Aug. 11, 2020) put it, wineries are not "buying a product from a company…it's not that simple…[the] logistics of harvesting and caring for a vineyard block, [the specifics of] how that work has to be done, needs to meet the needs of a number of stakeholders." Put simply, grape growers must sometimes balance the competing demands of different buyers. The connection between a grape grower and a winemaker is an intimate one; some say that "wine is made in the vineyard," which leads some winemakers to continuously monitor the conditions in the vineyard over the season even if the vineyard is not directly owned or managed by the winery.

However, there are other methods for grape sourcing and winemaking as well. Some vintners take a more "hands off" approach, preferring to buy fruit from contracted growers via established contracts, which can be negotiated at the beginning of the season, annually, or on some other timescale. Some prefer to buy fruit off the open market as it becomes available. Others take a mixed approach, doing some or all of the above. As one winery owner said, the idea is that, with good communication, the grower and winemaker can "hopefully steer things in a direction that makes sense for us and also for them" (Winery Owner B, personal interview, Aug. 11, 2020).

Whichever model is used, "growers often want to know before they plant what [grapes]...will be in higher demand," being highly aware that there is "a symbiotic relationship between growers and the wine producers" (Winery Owner B, personal

interview, Aug. 11, 2020). Relationships between growers and wineries do not just amount to weekly phone calls and email chains throughout the year; in addition, winemakers will often stay nearby multiple nights in a row over the course of several weeks during harvest season and visit vineyards regularly throughout the year to monitor what is going on in the vineyard to get a sense of what the fruit will be like come harvest time. These kinds of monitoring and collaborative visits is how I have built relationships in the industry first hand.

When it comes to growing grapes, Texas is "...a huge state. We're never really going to be married to one varietal or two varietals or something like that" (Winery Owner A, personal interview, Aug. 12, 2020). Each AVA in Texas is suitable for growing multiple varieties; however, what grows well in one place may not do well elsewhere. For example, Syrah, which grows well in the Hill Country, may not do as well in the High Plains, while Riesling thrives in the High Plains, but not in the Hill Country. There are ways, however, to work around some of these limitations - e.g., a different variety of grape can be grafted on to the rootstock of another in order to engineer a vine to be more suitable for the conditions in which it will be grown - but cooler-climate or warmer-climate grape varieties do have their limitations, even if grafted.

The overall quantity of fruit grown in Texas is not the only factor that inhibits wineries from buying Texas-grown; the fruit that is available to purchase also costs more, relatively speaking. As one winery owner explains, "There is no question the fruit is more expensive in Texas, and that continues to be a challenge [for us]. Because we are 100% Texas, we sort of accept the cost as part of the way we do business. We view it as having both a marketing advantage…but it is also a sense of authenticity, it's just part of your

identity…every year is different in Texas" (Winery Owner A, personal interview, Aug. 12, 2020). Due to the geography of Texas, you get a little bit of everything when it comes to weather; however, the unpredictable and inconsistent weather is, in essence, what makes the grapes grown in the state so different from year to year, which can actually be a benefit. For instance, in a drought year, you may have more raisined fruit, giving a high-skin to low-juice ratio, which produces more dark fruit flavors. In contrast, in a typical year, or a year with a higher amount of rainfall, different characteristics emerge in the fruit, and you can taste those differences in each vintage of wine. "We have a lot of challenges here, but there is a distinctive taste, [and] that is something that becomes irreplaceable" (Winery Owner A, personal interview, Aug. 12, 2020).

There are so many types of wines that can be made in Texas, and industry insiders suggest there is no need to focus on perfecting only one variety. For instance, Tempranillo has been called "the grape of Texas" because it was one of the first lesser-known varieties found to grow well in Texas and then growers began to plant and expand vineyards with Tempranillo creating dominated grape on the market. However, most Texas wineries have dedicated Tempranillo wine programs, they also believe they do not need to invest much time on the varietal. This is because there are ample opportunities for other "great finds" in so-far-undiscovered varieties as the wine industry in Texas continues to grow. Other wine regions may be limited to only a handful of varieties that are suitable for their environmental conditions, and winemakers there may spend years perfecting the style of a single varietal wine. However, in Texas, a wider range of varieties perform well, so growers and winemakers can remain flexible, both in terms of varietals grown and in terms of wine styles produced.

The relationship between wineries and vineyards is unique and has matured over time into a situation wherein one region could not be as successful without the other. Winemaking starts in the vineyard and "wineries in Texas are experimenting and pushing the envelope to create some really wonderful, high-quality wines that you can't get everywhere" by using their relationships with growers to get to that status (Williams, 2020). By making a unique and high quality wine, growers are experimenting with practices that really take advantage of what the environment has to offer and selling a product to consumers that embraces the realistic nature of a product that can be unpredictable from year to year – and consumers are comfortable with that (Williams, 2020).

Social and Economic Opportunities

As the number of wineries in the Hill Country grew, the lack of attendant – and essential – infrastructure became apparent. The support infrastructure began to slowly follow and more wine industry vendors moved into the area and have helped make production and distribution easier. "There was a time ten years ago when managing to get your hands in a timely way on winery supplies was a difficult venture at large; they weren't available locally, everything was shipped in. Those vendors didn't want to cater to smaller winery operations because the cost of sale was too high to do that. Today it's a massively better environment in that way. Winery supplies and winery equipment - readily available, also true with barrel supplies. Things are much better now." (Winery Owner B, personal interview, Aug. 11, 2020). Now the industry has reached a scale that makes operations here feasible, equipment retailers have located here, using the port of

Houston to bring in European tanks, presses, and production equipment at a lower cost than using distribution companies located in California or New York.

The presence of equipment retailers allows smaller and boutique wineries (which represent a large portion of the total number of wineries) to obtain processing aids that are well-suited to their smaller production size, something that was unavailable to them in the earlier days of industry. These better-tailored options are often more cost effective and allow these smaller wineries to benefit from piggybacking on the shipments that larger wineries have coming in bulk. This cooperative relationship encourages the best price for the best product for the consumer, which strengthens the foundation of the industry overall. Although different wineries are ultimately competitors for consumer and tourist dollars, this kind of "coopetition," bridging of cooperation and competition (Chim-Miki & Batista-Canino 2017), which improves business for all parties involved. The benefits for coopetition in emerging wine regions (or beer districts or the like…) has been explored elsewhere, and has been shown to help a place "make" itself into a wine region (Myles and Filan 2019).

Despite being indispensable as the industry ramped up, High Plains producers lacked certain resources essential for winemaking -- like crushers and destemmers, tanks setup with glycol lines for cooling, and presses. To help address these issues, custom crush facilities have now been established near large vineyards and provide a place for winemakers to use to begin their winemaking journey. These kinds of facilities expedite the processing of harvested fruit, allowing fruit to be pressed right away (called the "direct-press method"), which is valuable for making rosé and white wines. It also helps to minimize the growth of any bacteria that could compromise the grapes and create a

spoilage of wine. Until recently, without the availability of such production facilities and machinery, winemakers would be pressed to compromise their aspirations on wine style or quality - or they might be forced to resort to “old world”-style winemaking techniques (such as barrel fermentation or whole cluster fermentation) and accept the added risk of bacteria exposure.

Custom crush facilities aid in the production of wines, particularly for smaller wineries, by providing a place to crush their freshly-harvested fruit (an essential step prior to fermentation) while reducing their equipment costs. The existence of such a facility means that crush equipment need not be purchased directly by these small businesses; instead they can rent equipment shared with others, making the overall cost more manageable. Another benefit of custom crush is that excess, uncontracted fruit from growers can be processed promptly and properly and, ultimately, stored to create bulk wines. “Bulk wines" are then used to create a baseline wine that winemakers can further vintner later to meet the needs of their individual wine programs. This bulk wine program has proved to be useful in the event a particular wine is in demand, from either the distributor or consumer, and cannot be remade with current vintage inventory. Winemakers can look at the bulk wine market from that particular year and pull something that would be suitable to meet those demands. Otherwise it would be impossible since grapes are on an annual cycle and cannot be produced on demand like some other beverages (Winery Owner A, personal interview, Aug. 12, 2020). The presence of bulk wines after harvest provides a kind of insurance policy for wineries who would otherwise have to disappoint distributors or see their wine programs suffer. In addition, the market for bulk wine supports growers such that they can work to increase

their harvests confidently year-to-year without worry that uncontracted fruit will go to waste.

Further, bulk wines made from Texas grapes help wineries to build their "Texas-grown" wine portfolio, which is extremely valuable as consumers begin to demand 100% Texas grown fruit, as local palettes become more refined, and "truth in labeling" rules and regulations increase buyers' awareness of product sourcing (Meewes, 2017). In contrast, in earlier years, when wineries could not always procure an adequate supply of fruit in a given year, they would/could bring in bulk wines from out of state to fill in the gaps. This was one strategy winemakers used to survive in the industry's infancy, before growers in Texas could supply the demand for grapes. However, this practice is becoming less common each year.

Texas Wine Improves with Age: Growth Strategies

Professional certification programs, such as those offered by Texas Tech University (in Lubbock, TX), have played an important role in wine industry education. In 2002, Texas Tech expanded its offerings through a satellite campus in the Hill Country at Fredericksburg, where it offers viticulture and enology learning opportunities. Likewise an influx of wine consultants providing advice to both growers and winemakers on different aspects of the business has contributed to an overall improvement in wine quality. As growers, winemakers, and other industry stakeholders become better educated, production becomes more efficient, wine quality improves, and the industry as a whole benefit.

A few wineries in Texas distribute their product, but many do not, relying instead on on-site sales for revenue. The choice whether to distribute has several implications. For example, if a winery opts to conduct predominantly on-site sales, there is less pressure in terms of the required scale of grape or wine production. Sales via distribution channels (versus on-site sales only) are not essential for many wineries to cover their overhead costs, but this is a form of marketing that allows wineries to reach a market outside of their local parameters. As one winery owner would put it (Winery Owner B, personal interview, Aug. 11, 2020): "Most Texas wineries are relatively small [in comparison to] the grand scale of [the] wine industry across the world, so we often do things by hand. [We're] a little more artisan." Whether the decision is made to distribute or not, Texas wineries benefit from a unique marketplace, where the plethora of Texas pride often inspires local consumers to opt for Texas products over those produced elsewhere.

The wine industry in the Hill Country, where most wine tourism occurs, has benefited over time as additional businesses emerged to meet the needs of industry actors already in place. Wine tour companies, for example, have been established to address problems and concerns. Such companies accommodate tourists by bringing them in contact with several wine purveyors in one day, while keeping them safe. It is in everyone's interest to have wineries work together with such companies to bring customers into contact with wineries - both big and small - in a safe and calculated manner. Like any industry involving alcohol, additional measures must be taken for the safety of tourists and residence. Being in a rural area, it is uncommon for ride share

services, like Uber and Lyft, to be fully operated and be useful when needed according to an industry insider.

Another growth strategy for wineries, facilitated by winery visits, is the use of wine club memberships. When a consumer visits a winery and has enjoyed the experience, they might be enticed to become a winery "member". These memberships play a vital role in the business models for wineries both large and small since they help to create a steady stream of income, revenue that can be counted on even in unpredictable times. As mentioned previously, this model became viable in 2005, when a bill was passed in Texas that allowed wineries to ship wines directly to consumers (Fauchald, 2005), appealing to consumers who desired regular wine shipments from their favorite wineries. Incentives for wine club membership vary between wineries but offering perks and discounts are a way to bring members into the winery more regularly and hope to expand the winery membership to their guests.

As the number and size of wine clubs grew, Wine Cub (Wine Cub, 2020), emerged as a business solution for individual wineries. Instead of the winery managing the shipment of wine club allocations throughout the year, a contract with Wine Cub shifts the administrative burden away from wineries, and, further, allows wineries to ship to the majority of the United States using a single contract instead of needing to acquire individual permits for each state, which would be necessary otherwise. This solution allows wineries to focus on selling memberships and building their clientele without the hassle of managing the shipments themselves or cost and storage of shipping materials.

V. DISCUSSION AND CONCLUSION

Although Texas ranks fifth in terms of wine production, the economic impact of the wine industry in the state, estimated in 2017 to be $13 billion, ranks third, behind California and New York (Mamardashvili et al., 2017). Wineries stimulate local economies through both the direct and indirect provision of jobs and tax revenue which help support the economic pillar of sustainability in the emerging Texas wine industry. Wineries have made the Hill Country a destination; and tourists not only visit the wineries, they also stay in the hotels, eat in local restaurants, and shop at local retail outlets which all impact the community of the local residence. The pillars of sustainability can be satisfied as they are becoming balanced with the evolution of the wine industry growth. The compounding economic benefits of a thriving fermentation-focused region can be significant (Slocum, Kline & Cavaliere. 2018). However, there can also be drawbacks to these kinds of fermented landscapes (Myles et al. 2020), such as a significant increase in traffic volume and congestion, particularly in Fredericksburg, where the increase in traffic has been viewed as a safety issue (TXDOT, 2020), particularly in light of the increase in potentially intoxicated drivers on the rural roads. However, the needs for safer transportation can be satisfied with the upcoming availability of tour companies.

However, the place-based impacts of this fermentation-focused economic development are generally seen as positive overall (Hiner, 2016, Myles & Filan 2017). For instance, the Texas Hill Country Wineries Association (THCWA) (Texas Hill Country Wineries, 2020) has hosted multiple events over the years that draw visitors into the Hill Country for a month-long wine tasting event multiple times through the year. An

interview with a THCWA board member revealed that these events not only generate revenue for the industry, but also encourage consumer education through wine tasting and interactions with winery personnel (Wine Educator A, personal interview, Aug. 12, 2020). Over fifty wineries participate for each of these events, four times a year, and each event sells out. In 2007, there were 200-400 tickets per event available, a number that increased to 600 tickets per event just three years later due to the demand. In 2019, the tickets sales were increased to 800, and each event continues to sell out (Wine Educator A, personal interview, Aug. 12, 2020). For the Hill Country, this has added increased traffic into the wineries, but has also increased the demands for other services (e.g., lodging, private tour companies, dining establishments, etc.), which provides an economic boom to the whole area. These events are not important only for the Hill Country, but also for the High Plains growers who supply the fruit for the wineries. Revenue from these events satisfy the economic pillars in both regions.

While the industry is growing and maturing in both regions, it is clear that the Hill Country is better suited for wine tourism because the High Plains simply lacks the infrastructure needed to be hospitable to visitors and guests. The Hill Country features the majority of the production facilities in the state and has more to offer than just wine to potential visitors. There are other activities available that appeal to a range of age groups, with diverse activities the whole family can enjoy, and a scenic natural landscape to enjoy unlike the High Plains. Even wineries with no intention of planting vineyards, land clearing (of cedar trees) is essential for any development on the property for tasting rooms, parking spaces, and production areas which is helping with water infiltration in

the Hill Country and relying on High Plains relationship with growers who are using more environmentally sensitive crops meeting the needs of the environmental pillar.

While the Hill Country has evolved to become a wine-based destination, the region's wine tourism is an essential complement to the growth of vineyards and processing facilities in the High Plains. These two regions, though separated by more than 300 miles, have become closely intertwined and could not succeed without the other. Viticulture and enology focused business and infrastructure have developed in step with, and for, the wine industry in Texas, providing a critical support system for its expansion as needed. As wine production and consumption landscapes have shifted and grown in the state, social and cultural changes have followed in addition to positive economic trends and environmental benefits.

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