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Save Water Drink Wine: Challenges of Implementing the Ethnography of the Temecula Valley Wine Industry into Food-Energy-Water Nexus Decision-Making

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by

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experience many years ago and it will continue to be a part of my life for many years to come.

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Dedication

I dedicate this dissertation to my daughter, Amelia. I pursued my degrees during your childhood and you thought I was in school forever. My academic journey is ending when yours is about to begin. I hope I inspire you to follow your dreams just as you inspired me to follow mine.

Thank MOTU for helping me face my fears.

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Abstract

This study demonstrates the interrelationships of people, food, energy, and water associated with Temecula Valley's wine industry and reveals contradictions and biases in how people view these resources, which ultimately shape management and policies. The FEW (Food, Energy, and Water) Nexus is an approach increasingly used by policy- and decision-makers to understand the interrelationship of several resources. However, a FEW Nexus approach often lacks in social aspects that influence environmentally and economically sustainable outcomes, especially in the wine and wine tourism industry. When quantitative and qualitative data are available, the other challenge is which assessment to use. Two assessments often employed by decision-makers are Life Cycle Assessment (LCA) and Systems Dynamic (SD) modeling, and each can be reductionist assessments due to model and data limitations and researcher bias. In addition, anthropology lacks ethnographies that focus on human responses to multiple resources to provide qualitative data for these models. Therefore, this ethnography examines how stakeholders in Temecula Valley's wine industry relate to food (wine), energy, and water, especially when facing a significant drought in Southern California during 2015-2016. The results indicate that people's ethnicity and role in the wine industry shape perception of resources and affect how stakeholders collect and share quantitative and qualitative data for FEW Nexus assessments. Stakeholders demonstrated varying levels of resistance to internal and external policies in order to support Temecula Valley's terroir and aesthetics. To meet the challenge of including ethnographic data into FEW Nexus assessments, this

researcher recommends using a hybrid model that combines the strengths of LCA and SD modeling and using inputs collected by a diverse research team to understand policy resistance and provide context-sensitive solutions.

Chapter One

Introduction

This research is an ethnographic study of perceptions of the food, energy, and water (FEW) nexus of the wine tourism industry in Temecula Valley, California. This study aims to demonstrate the interrelationships of people, food, energy, and water associated with Temecula Valley's wine industry and reveals contradictions and biases in how people view these resources, which ultimately shape management and policies. People in Temecula Valley faced the challenge of facilitating increased water demands for agriculture and tourism development during California's longest recorded drought to date, spanning from December 2011 to March 2019, according to the National Integrated Drought Information System (2020). This drought was following on the heels of the previous drought that lasted from 2006 to 2011. The moment drought occurs is determined through precipitation, temperature, soil moisture, snow cover, water levels of streams and lakes, and meltwater runoff from ice and snow (National Integrated Drought Information System 2020). California did not have an opportunity to recover from one drought before the other began, which caused much hardship for residents, business owners, and farmers in different ways.

One of the valley's most prominent economic drivers in this semi-arid environment is the boutique wine industry. The first commercial vineyards and wineries started in the late 1960s and early 1970s when the valley increased its wine production from zero

vineyards to over 40 wineries by 2016. Some people envisioned a more significant wine industry that could create a greater economic impact for Temecula Valley. So in 2014, Temecula Valley approved community plans to increase the number of wineries in the appellation to 100 by the year 2020 (Dillon-Sumner 2014; Yelvington, Dillon-Sumner, and Simms 2014; Yelvington, Simms, and Murray 2012). However, this expansion was not limited to growing more grapes and making more wine. The 2020 Plan also encourages wineries to expand their tourism market. However, the valley may not have considered the adverse effects of development on their industry. People's perception of resources and resource management in the wine industry may contribute to how they carry out this expansion.

Wine production is viewed as a water-efficient agricultural product (Simms 2013). Still, the associated wine tourism industry, which involves wine tasting rooms, restaurants, and hotels, has not been fully explored for water consumption, energy use, and land development (e.g., Filimonau et al. 2011; Ganbavale 2018). Critics of the 2020 Plan argued there is not enough land in the 18,000-acre valley for 100 wineries due to the already present growth (housing, equestrian, and wineries) and the lack of suitable land for vineyards in the future to sustain this booming wine industry. Moreover, by 2020, there were not 100 wineries in the valley. Also, the growth of Temecula Valley creates incentives for others to develop competing vineyards and wineries outside the valley, which leaves less space for any other agricultural products historical grown in the area (e.g., citrus, avocados, and olives). The researcher will explore how people that work and live in Temecula Valley's Wine Country perceive (F)- wine as food, (E)- the energy to produce wine and wine tourism, and (W)- the water to sustain the entire valley. These

perceptions offer insight into how people interact with resources and negotiate resource management to grow a wine tourism industry during a drought.

The National Science Foundation (2015), which funded this study, defines the FEW System (i.e., nexus):

> very broadly, incorporating physical processes (such as new technologies for more efficient resource utilization), natural processes (such as biogeochemical and hydrologic cycles), biological processes (such as agroecosystem structure and productivity), social/behavioral processes (such as decision making and governance), and cyber elements. Understanding these complex, dynamic coupled systems will require new or enhanced partnerships across many disciplinary research communities.

Ethnography and the FEW Nexus

Anthropological research on the FEW nexus is limited (Wells et al. 2016) because most of the research focuses on one rather than multiple resources. To address the challenges of managing interacting resources, engineers have incorporated what they term a "water-energy nexus" perspective, which relies on quantitative data for assessments and assumes equal access to resources. One of these quantitative assessments used by engineers is the life cycle analysis (LCA). The water-energy nexus is a concept that is used to assess the social, economic, and ecological costs of a project against its benefits. Engineers calculate how much water is used to produce energy for consumption (e.g., Gleick 1994; Rio Carrillo and Frei 2009; Spang 2012), or how much energy is used to create, store, and distribute water (e.g., Siddiqi and Anadon 2011; Santana, Zhang, and Mihelcic 2014). A growing sector of the nexus relates to the connection of food production with energy and water (i.e., FEW nexus; Hoff 2011), while some studies also include land (Lawford et al. 2013). People can divert water from crop irrigation to energy production systems, or dedicate water to crops to produce biofuels

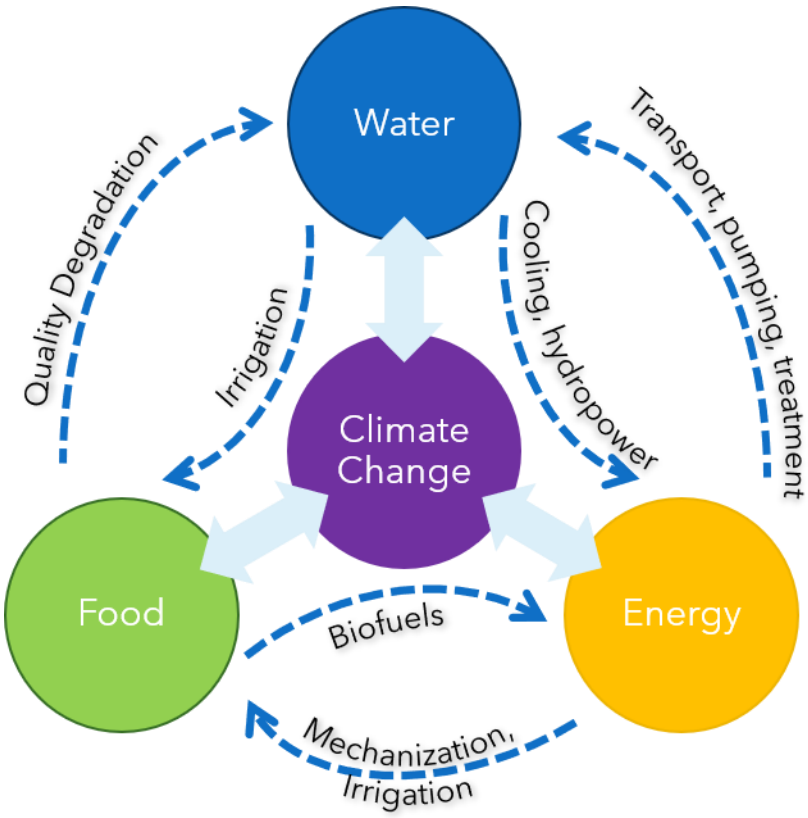

Figure 1. The FEW Nexus. This image reflects a quantified FEW Nexus lacking social aspects. Image created by author.

used in energy production (Figure 1; Bazilian et al. 2011; Hoff 2011). There are various life cycle analyses or assessments. Engineers use these assessments to calculate a product or process's environmental sustainability, commonly known as footprints (e.g., carbon footprints or water footprints). However, there are a few issues with this type of assessment.

First, LCAs on the wine industry lean heavily on vineyard management, which is easier to quantify. Also, there is not enough data on winemaking production or the hospitality sector of the tourism industry. Second, the wine industry's regional concepts of terroir may cause problems with how people are quantifying resources, as I will demonstrate in this study. Terroir is defined as the physical factors that affect the wine

grape's quality and taste, specifically soil, or terrain, and the climate. Social constructions are not included in this standard definition, such as knowledge of culture or place (Ulin 2013; Demossier 2011; Aurier, Fort, and Sirieix 2005). Third, even if quantitative data were available for an LCA, the numbers cannot represent every wine region or specific to a semi-arid environment. Finally, depending on the LCA, the analysis does not consider policies or behaviors that could affect the quality of human life or an engineered solution's sustainability. The management of multiple resources requires more than quantitative data to achieve an efficient engineered system and policies to support it.

Another environmental assessment that incorporates qualitative data is Systems Dynamic (SD) modeling used by engineers, public health personnel, and other decision-makers. Systems Dynamic modeling explores complex dynamic systems through computer modeling and simulation. However, this technique is critiqued for being reductionist or benefit select groups of people rather than the whole community (e.g., Givens et al. 2018) when the community is not involved, so the researcher is the only one to decide what behaviors are added to the model. In addition, the technique would require a long-term commitment, since events can occur that will require an update to the model and policies. Sterman (2002) is a leading scholar on SD modeling. He implies that engineers need to acquire ethnographic skillsets, suggesting a polymath approach (Renaissance Man), which may add to the researcher bias since engineers are not trained for this specific task. This researcher suggests that a better alternative is transdisciplinary collaborations. Nevertheless, these SD models have been used to work with stakeholders to create and implement policies with more success (Forrester 2007). Researchers need ethnographic data to understand how people relate to multiple resources, which can

enhance solutions that provide culturally-relevant, equitable, and sustainable resource management.

Anthropology can and has contributed to FEW nexus research in recent studies. For example, Christine Prouty (2018; Prouty, Mohebbi, and Zhang 2018, 2020) is an environmental engineer who used qualitative data about the people of Placencia, Belize, which was collected by a team of anthropologists from the University of South Florida, Department of Anthropology. She entered ethnographic data into a Systems Dynamic model to determine the success of a bottom-up, community-based approach to improve wastewater management. She compared the results against a similar SD model on residents in the Florida Keys using a top-down approach. Anthropologists were not actively collecting ethnographic data on stakeholders in this location; thus, she relied on quantitative data and institutional reports. She concluded that both approaches were necessary for a holistic and context-appropriate solution to wastewater management. Also, she demonstrated how ethnographic data does enrich a study to provide geographically and culturally-appropriate recommendations.

This example also reflects how the lack of anthropological data and training may provide inaccurate results. For example, anthropologists would not compare two historically and culturally-different communities, like Placencia, where most of the residents are predominantly of African ancestry to residents of the Florida Keys who are mainly white and affluent. These two coastal communities have a wastewater management problem, and both may have similar environments that deal with tropical storms and tourism, but this is where the similarities may end. Prouty demonstrated how transdisciplinary research that includes ethnographic data enriched her results. However,

by ignoring each site's history, ethnicity, and gender dynamics to operationalize an approach, she may have overlooked some issues. She suggested that everyone should be engaged in planning and development, but social and political dynamics prevent *everyone* from participating. Applied Anthropology can provide social context to make sure the model is considering the right parameters, which means there needs to be a breakdown of silos among disciplines. Learning how anthropologists, engineers, and other scientists can work together effectively is becoming the most significant problem to FEW nexus research, but it is also a challenge applied anthropology is equipped to overcome.

Addressing Challenges

Recently, California has suffered from one of the most severe droughts on record (2011-2019). In response, Governor Jerry Brown declared a drought state of emergency in January 2014 to prepare the State for potential water shortages. California is one of the nation's most significant sources of produce, dairy, and wine (Department of Food and Agriculture 2019) and in the state with the largest population in the country (Census 2019). To sustain the people as well as the agricultural industry requires not only water but also energy. Processing fossil fuels or creating energy from water sources, such as hydroelectric dams, requires abundant amounts of water (Gleick 1994), which adds fuel (pun intended) to this crisis. The California drought provides an opportunity to understand from an anthropological perspective how people view, structure, and negotiate the management of multiple and interacting resources when there is a deficit of one of the resources. Specifically, this research focuses on how the booming wine tourism industry

in Temecula Valley, Southern California, responds to the drought and how a qualitative assessment (ethnography) on resource interrelationships can contribute to engineered FEW nexus perspectives and policies. Also, this research can explain the community's reluctance to adopt some engineered solutions while embracing others.

Temecula Valley

Temecula Valley is an American Viticultural Area (AVA) located in Temecula, Southern California, in southwest Riverside County about an hour north of San Diego (60 miles) and an hour and a half East of Orange County and Los Angeles (90 miles) by car. Residents of Southern California are accustomed to long commutes to have good-paying jobs while enjoying affordable housing. Temecula's population grew from 28,000 to 115,000 residents in three decades (Census 2019). Its wine industry grew along with it. Now Temecula Valley is even referred to in television and streaming shows depicting Southern California living, such as on episodes of "Real Housewives of Orange County" and "Grace and Frankie." These shows reflect that Temecula Valley is ideal for grape growing and tourism development. However, most people may not consider wine production as synonymous with Southern California living. In fact, it is the first area where wine production began in the late 18th century to support the needs of the Spanish missions along Southern California's coast before it became part of the United States.

Southern California's success with the wine industry was due to its Mediterranean-like climate. Temecula Valley has an average annual rainfall of about 12 inches with a rainy season from December to March. The wettest months are January and February, which average 3 inches of rain per month. So, half the annual rainfall occurs during the

grapevines' dormant period right before bud formation. For the rest of the year, stakeholders can rely on drip irrigation to water grapevines during the hottest months. More importantly, grapes need a fluctuation in temperature from night and day, referred to as Diurnal Temperature Variation (DTV; G. Jones 2015; Hubble 2017). The right amount of DTV contributes to the level of sugars and acidity in wine grapes to create balanced wines, and it is one of the physical criteria considered in terroir. Temecula Valley is situated in a perfect microclimate about 22 miles east from the Pacific Ocean. This location allows for clear skies and hot desert days that turn into balmy nights as rising air draws in cooler coastal air through the Rainbow Gap and Santa Margarita Gap along the Coastal Mountain Range. Temecula Valley experiences consistent DTV of about 25 degrees from day to night in this semi-arid environment. The results are grapes that are high in sugar with the right amount of acid to balance wines. The temperatures are also ideal for tourists to enjoy fun in the sun, followed by cool evenings.

In the early 19th century, vineyards were devastated by Pierce's Disease (*Xylella fastidiosa*), which causes vines to wither and die (Calwineries 2020). It was identified in the late 19th century, then known as the "Anaheim Disease," and destroyed much of the Southern California wine industry. Over time scientists learned that a blue-green sharpshooter was the vector of the disease. In the late 1980s, a different species, the glassy-winged sharpshooter, was introduced from the southeastern United States, probably through plants. This species moves faster than the native insect and prefers to sleep in citrus trees. Citrus, olives, and avocados are also susceptible to Pierce's Disease and are crops that grow around Temecula. A portion of Interstate 15, north of Escondido and entering Temecula, is known as the Avocado Highway. As a result, glassy-winged

sharpshooter activity is highly monitored in Temecula Valley by vineyard managers. It also creates tension with farmers who still grow one of the valley's original crops - citrus. Still, the Temecula Valley wine industry was heavily hit by Pierce's Disease in the late 1990s, destroying half the acreage planted in vines. The valley went from 3,500 to about 1,200 acres of vineyards under cultivation before federal and state-funded research and intervention programs brought the disease under control.

Temecula Valley is an ideal place to test perceptions of resources because wine begins with the concept of terroir - climate and topography. Also, wines produced with the designation of Temecula Valley as an AVA generate more income and prestige. However, the growing wine and wine tourism industry is an incentive for other crop growers to switch to wine grape production and generate future competition. For example, avocado growers hurt by disease and the Mexican trade sanctioned by NAFTA (North American Free Trade Agreement) are switching to wine grapes to save water and receive a better return on investment. The drought creates more significant tensions when more farmers compete over scarce resources, and it also shapes how people perceive wine, water, and energy during a time of crisis.

In addition, the people of Temecula Valley decided to invest limited water resources into the wine industry to capitalize on the increasing tourism development (Yelvington, Dillon-Sumner, and Simms 2014), especially since grapevines require lower water consumption to produce wine grapes (Park and Lurie 2014; Mekonnen and Hoekstra 2011). However, skewed perceptions of resources may fuel stakeholder's decisions. Preliminary research I conducted in April 2015 suggests that engineers and wine producers in this area believe there is plenty of water within the valley despite the

drought state of emergency, even though 65%-70% of the water is imported from Northern California and the Colorado River (Rancho California Water District 2016). Water pumped from local aquifers accounts for 30%-35% of the water, and it is unclear how much water volume is available.

Also, the water and energy cost of a bottle of wine does not consider the resource costs of the accompanying tourism industry. For example, festivals, restaurants, hotels, and other tourism activities may divert water from crops or away from the valley (see virtual water; Allan 2003, 1998). People are making decisions on managing resources based on perceptions and incomplete information, which are often not included in nexus assessments. This knowledge gap is why engineers and social scientists demand that the FEW nexus extends beyond metabolism (production and consumption metrics) to include how the social aspects of resources shape and engage with society (Dale 2013; Kenway et al. 2011).

Theoretical Perspective

The challenge for residents of the area is how to make Temecula Valley's wine tourism industry more environmentally sustainable to achieve long-term equitable success. The United Nations (2020) defines sustainable development as development that meets the needs of the present without sacrificing future generations' ability to meet their needs. To understand how agriculture-oriented tourism can evolve to sustainable development begins with an understanding of how participants relate to resources and how they manage them within their industry. However, a FEW Nexus approach alone does not provide the theoretical framework that clearly incorporates qualitative data. The

anthropological theoretical perspectives that frame these environmental studies are political economy, systems thinking, and political ecology, and I will explain why I choose a political ecology approach supported by systems thinking for my research.

Political economy began in the 18th century through the works of Adam Smith, Thomas Malthus, and David Ricardo as an approach to study the relationship between production and the distribution of wealth, especially at the national level (aka capitalism). Karl Marx contributed to this framework by focusing on the internal tensions that occur under a capitalist economy. In the 19th century, while exiled in London, England, Marx observed the tensions between town and country that arose from poor resource management of multiple resources (land tenure, water, soil nutrients, food demands, and production). He observed the economic, social, and environmental implications of resources, specifically, food distributed from the countryside to the city where human and food waste, or nutrients, are discarded in London and away from farmland. These actions negatively impacted the farmland and the livelihood of farmers. He referred to the appropriation of the environment through labor and production as a metabolic "rift." He argued that the answer to studying the social aspect of the metabolism of multiple resources "was in human labor and its development within historical, social formations" (Foster 2000, 163). Marx was making an argument for including social aspects into FEW nexus research, as understood at that time. More importantly, his argument emphasizes historical context, which is often missing in nexus assessments.

Systems thinking was influenced by cybernetics and provides the opportunity to study the interconnection of an object, person, or process, like a circuit. However, to delve into the immaterial (e.g., spirituality, emotions, gut feelings) requires an approach that is

more inclusive. This study takes a political ecology approach to consider changes in the environment that will affect people unequally and for different reasons (Robbins 2012; Bryant and Bailey 1997; Paulson, Gezon, and Watts 2003). People will respond to their environment based on their perception, politics, and economic pressures (Bryant and Bailey 1997). Political ecology focuses on environmental changes and how people respond to that change, and the fluidity of this approach allows for non-human actors and non-economic factors to be included in the narrative.

In Temecula Valley, some stakeholders in the wine industry hesitate to collect nexus metrics, conduct nexus assessments, and adopt engineered solutions that could increase their socio-economic status and boost tourism. This response is sometimes based on their ethnicity and their relationships with non-human actors, which suggests that decisions by stakeholders in the wine industry are not always economically-driven, but rather used to construct individual ideas of tradition (terroir). Political ecology provides a more inclusive framework of studying environmental issues as they pertain to politics, economics, and society. This study explores how people involved in the wine industry embed their perceptions of food, water, and energy into the production of wine and the wine tourism industry in the Temecula Valley. Also, how their view of the environment affects how they execute policies to sustain their livelihood.

Research Question

The main research question is: how are perceptions of water and energy embedded among people working in Temecula Valley's wine industry, and how do they manifest in the production of food, specifically wine grapes, and wine, under the

conditions of tourist-oriented agriculture? This general question requires subsidiary questions: What strategies are winemakers and vineyard managers employing to save water and energy in the context of a historic drought in the region? What are the conflicts between actors in different structural positions associated with the industry (e.g., winery owners, winemakers, vineyard managers, agricultural laborers, tourism planners, state officials, tourists) regarding water and energy use in wine and wine tourism production? Finally, what are the challenges of collecting and implementing qualitative and quantitative data on the wine tourism industry to use in Nexus Metrics, like Social Systems Dynamics modeling and Life Cycle Assessments?

The FEW nexus is employed by engineers and decision-makers to design environmentally and economically efficient systems through environmental assessments, and therefore provides a compelling case study for an ethnographer interested in perceptions of the wine industry. One of the most common tools engineers can use in FEW nexus research is a Life Cycle Analysis (LCA, also known as a Life Cycle Assessment). Life Cycle Analysis is used to predict the environmental impact associated with the life of a product, service, or process from cradle-to-grave, or cradle-to-cradle (closed-loop). The public is more familiar with the results of a life cycle analysis as carbon (CO_2) or water footprints used to communicate the environmental impact of their consumption to steer people to more sustainable choices during a drought. For example, almonds were often the target since California produces 82% of the world's supply and is the highest yielding crop at $6.1 billion in 2019, followed by grapes at $5.4 billion (USDA National Agricultural Statistics Service 2020). However, almonds used more resources than grapes. For example, Figure 1 demonstrates how one almond requires 1.1 gallons

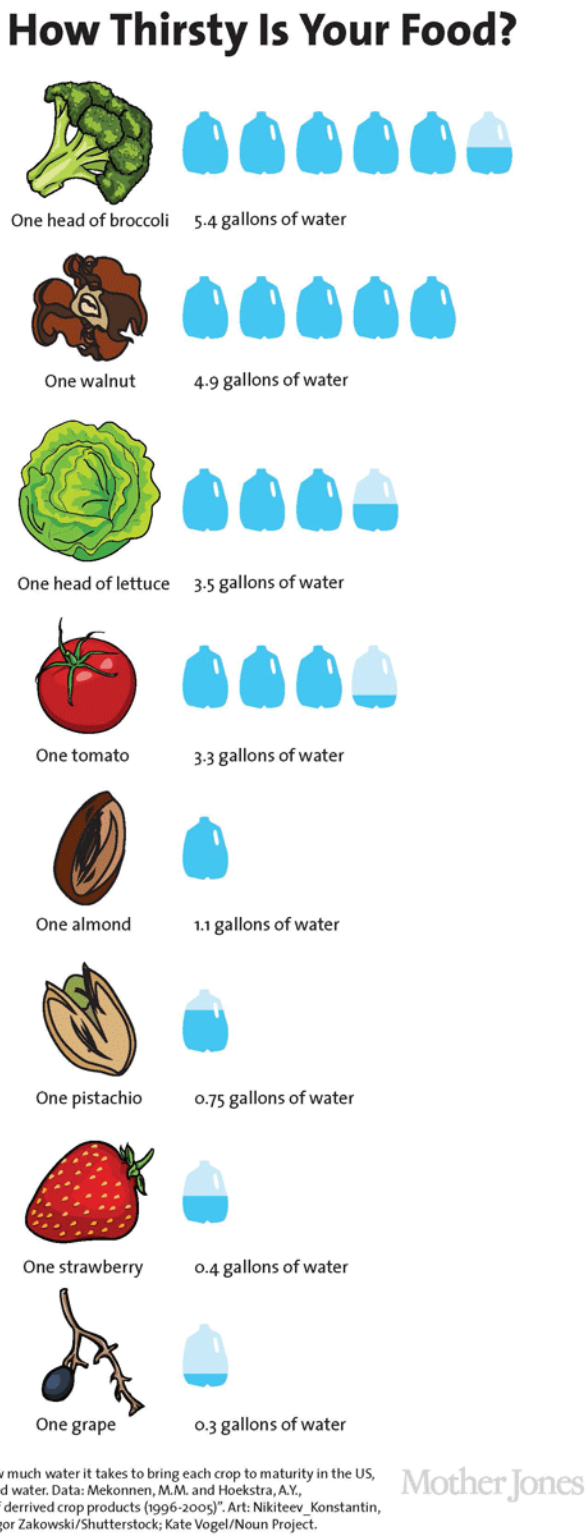

Figure 2. How Thirsty Is Your Food? The media used figures like this one to educate people about how their food consumption impacts the amount of water used by farmers to meet consumer demand. Almonds were often vilified as water hogs, creating tension among people requiring a plant-based diet. Reprinted from Mother Jones, 2014, retrieved: www.motherjones.com/environment/2014/02/wheres-californias-water-going. Reprinted with permission.

of water (Park and Lurie 2014; Philpott 2014). Almonds also generates its weight, pound for pound, in CO_2. (Dennehy 2015), while one grape requires 0.3 gallons of water (Park and Lurie 2014). Grape production does not produce a significant amount of CO_2, as this research will demonstrate, so the carbon footprint is calculated by an average bottle of wine, which generates almost 3 pounds (1.28 kg) of CO_2 (Lardie 2020). A consumer can feel less guilty drinking wine than eating almonds based on this information. These assessments were offered to the general public through websites and demonstrate the marketing appeal of LCAs, which focuses on consumption decisions. However, the best use of LCAs is to reveal “hot spots” for areas in production, service, or process that use more resources to improve the positive environmental impact.

Improvements to systems will require some form of interjection in policy or human behavior. Another common assessment tool used in FEW nexus metrics is Systems Dynamic modeling, which predicts the effects of policy and behavior on environmental resources based on quantitative and qualitative data. However, this type of assessment requires robust ethnographic data to aid the results and recommendations. It can be reductionist and ahistorical due to the complexity of the social system being modeled, as I will explain further in this research. Both assessments are useful tools for calculating strategies towards sustainable development but depend on the quality of the inputs, or data, which is why Prouty (2018) understood that to operationalize her top-down and bottom-up approaches for her SD model required engagement of stakeholders at several levels.

One of the challenges environmental engineers face is successfully implementing engineered solutions into society. Failure of an engineered solution is often due to

perceptions of resource management that cause misuse or resistance of use, which is an input that can be used in SD modeling. One such example in Temecula Valley was adding water meters at a winery to self-monitor water usage during wine production, which was part of Simms's dissertation (Simms 2013). Simms was studying the socio-economic and environmental impacts on water used for winemaking in Temecula Valley. Water use in vineyards is easy to calculate since emitters used in irrigation have a rate of flow. Simms recognized that these calculations could not occur for winemaking because the amount of water used for this event was lost among the facility's water use for the whole year. Therefore, he installed meters to monitor water use during winemaking production. One of his conclusions is that winemaking is more environmentally-friendly when compared to residential housing. These results help support increased wine industry production over housing development within Temecula Valley. By adding meters, the participants could continue monitoring their water use to improve water consumption as they increased or improved production, especially during a drought. Instead, shortly after Simms left the research site, the winery removed the meters.

There is a water pricing paradox that may explain this behavior. Grafton, Chu, and Wyrwoll (2020) explain how the price of water does not equal its value or cover costs for storage and distribution, referred to as the diamond-water paradox (Smith 2007 [1776]). Often water managers will tier the cost of water, so consumers pay more after using their allocated amount, but this has varying results when balancing efficiency over equity (Grafton, Chu, and Wyrwoll 2020; Luby, Polasky, and Swackhamer 2018; Ashoori, Dzombak, and Small 2016; Maggioni 2015). Also, the water industry, with its aging infrastructure, is under pressure to provide water to two sectors: the agriculture sector,

which uses 70% of water while keeping food prices low, and the growing energy sector, which is the second-largest water consumer (Vandone et al. 2018). Vandone et al. (2018) explain how there is little incentive to improve infrastructure because the water industry has a low return on investment than the other sectors. Water value does not equal its worth or cost. Adams et al. (2013) suggest that better education results in behavior changes, but this dissertation will demonstrate how people's beliefs or relationships with resources contradict this idea.

People in food-producing industries can benefit from adding an anthropological perspective because of the geographical and culturally-specific relationships humans have with certain foods. In wine production, terroir is ingrained among wine enthusiasts as the essence that makes a fine wine. A wine expert is expected to taste the difference between each variety of grape and its terroir, like soil and climate. However, anthropologists have demonstrated that the social construct of terroir from one wine region to the next is more complex and politicized, going well beyond soil and climate (Black and Ulin 2013; Daynes 2013; Demossier 2011; Aurier, Fort, and Sirieix 2005).

Demossier (2011, 701-702) summarizes the history of terroir in France and how this concept was adopted in the twentieth century as a "socio-political movement to protect French agricultural products from internal and external forces." He explains how the concept of terroir is rooted in authenticity, tradition, history, and the past, which brings a diverse and sometimes unruly group of people together who use terroir as an economic tool. Ulin (2013) takes a Marxist approach to terroir to argue how people use this concept to naturalize agricultural products and production to shroud the social relations of production and consumption. He argues that terroir is used to bestow meaning and value

to wine, making it an object of commodity fetishism. He also blames academic and professional sources for anthropomorphizing grape plants and wines associated with certain terrains. Both of these scholars' wine research occurred in the famous wine regions of Burgundy and Médoc in France, the country where the concept originated. This study demonstrates how Temecula Valley embraces vague and individualized concepts of terroir as a means to bring stakeholders in the wine industry together. However, this researcher disagrees with Ulin and argues that terroir can acknowledge and include wine and grapes into social relations.

This complexity in the meaning of terroir may reveal how emotions and perceptions influence the wine industry. For example, Christ and Burritt (2013) reviewed the environmental assessment literature on Australia's wine industry. They concluded that more quantitative data and qualitative data are needed to understand the inconsistency in metrics collecting and engineered solutions implementation among wineries. Combining this data can capture a holistic view of the wine industry's social and environmental impacts. In essence, Christ and Burritt (2013) reflect that the same problem occurring at the national level with FEW nexus is also happening at the industry level –the need for more ethnographic data and proper analysis. Thus, this research provides a richer understanding of this social and agricultural product's complexity with its burgeoning wine tourism economy in Temecula Valley, California, including demonstrating participants' responses towards collecting and managing metrics.

Research Design Overview

This research employed a variation on the hydrosocial cycle to collect data. Jessica Budds (2009) introduced the hydrosocial cycle as a process to understand the relational-dialectic relationship people have with water. Simply stated, she recommends following the flow of water to see how people intersect and relate to the resource. Following the flow of water allows a researcher to focus on one object to map out how small interactions with resources contribute to the larger picture. For this research, I had to make some changes to include more resources. In addition, the national response to the 9/11 terrorist attacks and the California drought made people wary about allowing people access to water sources, so I could not follow the flow of water. Therefore, I will introduce the vinisocial cycle, which is a method I adapted from the hydrosocial cycle to follow the flow of wine rather than water. The flow begins with the grapes growing in the vineyard, then transformed at the wineries to wine, which supports a tourism complex in Temecula Valley.

Using what I have termed the vinisocial cycle approach, I collected qualitative data from archival research, participant observation, and semi-structured interviews among several stakeholders working in the wine industry. Stakeholders include vineyard managers and their laborers, winemakers, winery owners, and Temecula Valley residents that grow grapes for the wineries. I targeted various scales of wine and wine tourism production to observe variations in the perception of resources based on production. In all, I interviewed 37 people and documented my observations of 11 wineries, two independent vineyard managers, and seven residences with vineyards supporting the

wine industry. I wanted to interview enough people to see variations in interaction with resources and worldviews of resource management.

Rationale and Significance

This research uses the wine tourism industry in Temecula Valley to demonstrate the social complexity of multiple resources and provide parameters to consider in nexus metrics. The FEW nexus approach has gained increasing momentum since the turn of the century (Siddiqi and Anadon 2011; Hoff 2011; Bradshaw and Leck 2014; Department of Energy 2006; Nexus 2014). The World Economic Forum (World Economic Forum 2011) listed the water–energy–food security nexus as one of the most significant risks to the global economy. “The Nexus is considered a security nexus because, just as the goals for water security must be ensured for prosperity and peace, the hope for prosperity and peace is equally dependent on food and energy security” (Lawford et al. 2013, 607; UN-Water 2013). The information available often suggests that resource planners' primary concern centers on energy production, water availability, and resource conservation separately (Gleick 1992, 1994). Therefore, a nexus approach attempts to use quantitative data to assess the interrelationship between the resources so that the assessment results can aid decision-makers responsible for resource management (e.g., Siddiqi and Anadon 2011; Rio Carrillo and Frei 2009).

This study offers stakeholders' perceptions and investment decisions of embodied resources (energy and water) on wine grapes, supporting a tourist industry promoting a leisure lifestyle and conspicuous consumption. Stakeholders may favor wine grapes over crops that feed larger segments of the population, such as citrus, avocado, and olives

grown in the research area. This decision is influenced or reinforced by state and federal policies concerned with more significant economic impacts from the revenue of the tourism industry and alcohol taxes (Yelvington, Dillon-Sumner, and Simms 2014; Yelvington, Simms, and Murray 2012; Colman 2008). Also, wine tourism development will create higher demands for land and water, which are limited resources. If California, as a top agricultural producer in the United States, replaced more crops with “drought-tolerant” wine grapes, then production and access to a diversity of food crops would decrease, thus creating less food resiliency.

However, a nexus approach has several problems that prevent it from being a practical and holistic approach to resolving resource-use issues and could benefit from integrating an anthropological perspective. First, the interrelationships are studied linearly and do not often consider the connection between resources (Scott et al. 2011). In other words, the nexus assesses water to energy or energy to water, but not both simultaneously. Even Gleick (1994) discussed water and energy production separately from water and energy consumption while at the same time demonstrating how the two resources are connected. Second, a nexus approach may recapitulate the nature/society dichotomy (e.g., Schmidt 2014). Resources can be perceived to fall into the natural realm, while the infrastructures designed to act upon the resources are part of society. This dichotomy is hindering the creation of practical solutions and policies. Proponents of the nexus perspective argue for further inclusion of decision-makers to provide inputs of scale, environmental degradation, and social impacts (Bazilian et al. 2011; Scott et al. 2011). Also, they recommend policies that consider the interrelationship of multiple

resources instead of just one (e.g., water policies, air policies; Bazilian et al. 2011; Scott et al. 2011; Kenway et al. 2011).

The authors called for social inputs to nexus thinking included engineers as much as social scientists (e.g., Marsh 2008; Dale 2013). Kenway et al. (2011) explained that there is an abundant amount of studies on the environmental aspects of the FEW nexus. Still, there is a lack of information on the economic implications. Finally, the FEW nexus in any particular context may depend on partial, Western-based perceptions of resource management to guide policy- and decision-makers (e.g., Linton and Budds 2014 on water). Thus, when implemented in non-Western settings, or on non-Western people, the FEW nexus could result in changes to established social networks, redefine resources, and change the patterns of access, use, and control (e.g., for water, Johnston 1987; Johnston 1998; Budds 2009; Wagner 2013; for energy, Degani 2013; Strauss and Reeser 2013). Temecula Valley wine industry provides examples of how people view and apply a FEW nexus approach, as well as highlight limitations to the method.

The first problem is whether people define wine as food to include in FEW nexus studies, which is an entirely subjective topic, debated on, and steeped in history. According to U.S. law (United States Code 2010), food is defined as “(1) articles used for food or drink for man or other animals, (2) chewing gum, and (3) articles used for components of any such article” under Title 21 U.S. Code §321(f). Some people further define food based solely on nutritional values and may exclude wine as food, even when data on the nutritional value of wine are available through the U.S. Department of Agriculture (USDA; Duffy 2009). Other people include the beneficial health and social effects of food, which is a growing discourse (i.e., functional foods, Yoo, Saliba, and

Prenzler 2010; Ross 2000). Anthropologists have studied wine across the world as a constructive drink for trade, connecting identities, or conducting performance or rituals, among its many uses (Douglas 2003; Black and Ulin 2013), but few have discussed if wine is viewed or treated as a food source or category. This ethnographic research captures the attitudes of wine as food by people in Temecula Valley Wine Country - beliefs that contribute to resource management and policies.

Chapter Outline

This study has the following chapters. Chapter One is where I have introduced the research. Chapter 2 covers the Literature Review that inspired this research and the theoretical frameworks considered for this study. The chapter concludes with the political ecology approach I used to conduct this research. Chapter 3 covers the methods and methodology used to identify stakeholders and collect ethnographic data. I introduce the vinisocial cycle as the method I created and used to follow the flow of wine. The flow begins with wine grapes as they grow in vineyards. After harvest, they are sent to the wineries to make wine, which supports any associated wine tourism complex (e.g., hotels and restaurants), and any interactions outside of Temecula Valley that is relevant to this research. The focus was Temecula Valley, but as I will explain, sometimes, it is difficult to capture the full picture by staying completely within boundaries.

I begin examining the vinisocial cycle with Chapter 4, where I share the ethnographic research related to vineyards. I continue the Vinisocial Cycle into the wineries in Chapter 5, which discusses perceptions associated with winemaking. I conclude the ethnographic portion with Chapter 6 to discuss the wine tourism complex. I

conclude with Chapter 7, which discusses the many challenges of implementing ethnographic data into FEW nexus metrics, and how this research contributes to the anthropological record. I make recommendations for future research and discuss how I will share this information with the community.

Chapter Two

Literature Review

In this chapter, I will discuss the literature review used to support my research and explain how I shaped my theoretical approach to understand the interrelationships of resources in Temecula Valley's wine and wine tourism industry. Inspiration for this study came from the increasing popularity of the FEW Nexus to create a more environmentally and economically sustainable world. Engineers, scientists, and policymakers requested more information from the social science community to improve the FEW Nexus research and approaches. However, the FEW Nexus is a relatively new concept, so it is no surprise that there is also very little anthropology focused on multiple resources making this dissertation research a small but essential contribution to anthropology. First, there was one thing I had to address to conduct this study: the FEW in FEW Nexus stands for food, energy, and water, so I explain how wine, which is seen as a luxury good in the United States, could even be considered food that could play a role in food insecurity. The chapter ends with a summary of the literature review and offers the theoretical framework I will use.

Food-Energy-Water Nexus

The food-energy-water nexus is an approach to understand the interrelationship of these three resources - food, energy, and water - in terms of production and

consumption and its associated policies. This approach began with the water-energy nexus because engineers understand that water and energy are interrelated from a process perspective. Peter Gleick is a pioneer for studying these connections and their impact on the environment and global sustainability, and his early work demonstrates the quantitative nature of the water-energy nexus. For example, Gleick (1994) provides the amount of energy required to produce potable water. The theoretical minimum amount of energy needed to remove salt from a liter of seawater is 2.8 kilojoules (~.0008 kWh; Spiegler and El-Sayed 1994).

> It is perhaps easiest to think of the minimum requirement as the free energy change associated with the process of salt dissolution.... Assuming a process where fresh water is recovered from a salt solution (as opposed to recovering the salt from the water), it is clear that as the recovery of freshwater is increased, the remaining solution becomes ever more concentrated, thereby further elevating the boiling point, etc. Thus, as the recovery increases, the energy required to perform the operation must also increase (Miller 2003, 14).

In other words, Miller is explaining the extraction of freshwater using a thermal or distillation system – boiling the water out. The boiling point of salt water is 2ºC higher than freshwater, which boils at 100ºC (212ºF). The more salt in the water, the higher the temperature is needed to remove the freshwater. This action brings up the cost of desalinating drinking water when using a distillation system. However, desalination plants cannot operate within this ideal efficiency. Gleick (1994) remarks on how plants use as much as 30 times the theoretical minimum of energy, not including the energy needed to produce fresh water required to cool the plant and discharge effluent. Energy use depends on the size and type of plant (e.g., distillation, reverse osmosis, electrodialysis) and the salinity of the original water source (brackish versus seawater). Therefore, the

production of freshwater from desalination plants is limited by the amount and cost of energy (Gleick 1994), and other variables, like location, technology, and assessment tools and parameters (Cornejo et al. 2014). These decisions have social and political implications, which often go unexplored.

To demonstrate, Gleick (1994) provides an example of wheat production in Saudi Arabia, which used wells and desalination plants as their source of agricultural irrigation. In the 1980s, the goal for Saudi Arabia was to become wheat self-sufficient, which they accomplished for about 30 years. Wheat is a major food staple in Saudi Arabian cuisine. Wheat self-sufficiency was feasible due to Saudi Arabia's low fuel cost, which powered the desalination plants and well pumps. Still, Gleick predicted in 1994 that this decision would prove to be unsustainable in the long run. By 2016, Saudi Arabia phased out its wheat cultivation altogether due to a lack of land and water shortages (USDA Foreign Agricultural Service 2014; AgroChart 2016). What Gleick does not explain is why Saudi Arabia made such a maladaptive decision to become wheat self-sufficient in the first place. Saudi Arabia is not water-rich, but energy-rich, and an adequate amount of both resources are required for self-sufficient food production, so what was the socio-political event or perspective that influenced this decision? This example demonstrates how food security and national security are tied to the water-energy nexus and how anthropology could provide relevant qualitative data to nexus metrics.

Gleick (1994) also provides a table of the consumptive water use for energy production, which is still used today (Pacific Institute 2014). Power plants relying on fossil fuels require a large amount of water to extract the fuel (e.g., coal mining, enhanced oil recovery) and cool them. Often, it is more economical to locate power plants near sources

of water. However, many power companies service electricity to large geographic areas. For example, Southern California Edison services most of Southern California, including Temecula, and in 2016 relied on 41% Unspecified sources, 28% Renewable Sources (wind, solar and geothermal), 19% Natural Gas, 6% Large Hydroelectric, 6% Nuclear (Southern California Edison 2016). The electricity that cannot be traced to a specific generator is categorized as Unspecified sources and is typically electricity bought outside the State of California and could include carbon-intensive fuel sources like coal. However, California has lower emissions than the rest of the U.S. (Figure 1; Mihelcic and Zimmerman 2014; U.S. Environmental Protection Agency 2020).

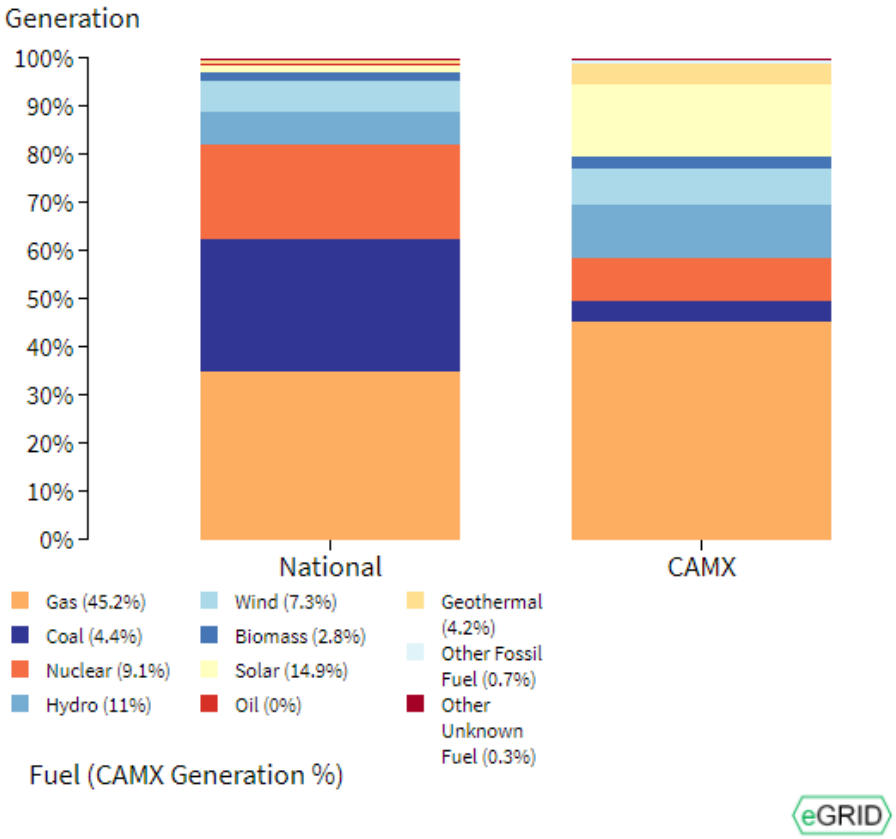

Figure 3. Fuel mix for the subregion CAMX. The CAMX quantities represented most of California. These quantities were compared to the U.S. Comprehensive data of the national power grid. Reprinted from the U.S. Environmental Protection Agency, www.epa.gov/egrid. Public domain.

In this example, to calculate the consumptive water for energy production would require calculations for each fuel source and generator. These calculations vary from year to year, depending on the power company's supply and demand, and federal and state government efforts to reduce greenhouse gas emissions. These examples are a small reflection of the complexity of quantitative metrics without including the social aspects.

Life Cycle Analysis

Over the years, the production of just about any product has become more complex. In addition, the post-World War II baby boom (1946-1964) may have led to heightened concerns by the 1960s over accounting limited energy resources and raw materials for future use (Scientific Applications International Corporation 2006). This situation inspired the first LCA by Harold Smith. A Life Cycle Assessment is a method of quantifying the environmental impact of a product, process, or service beginning with the extraction of raw materials until it is disposed of (cradle-to-grave) or recycled (cradle-to-cradle). There are other variations of LCA, but this is the basic definition. Smith reported his calculations at the World Energy Conference in 1963 on cumulative energy requirements to produce chemical intermediaries and products. These chemical reactions help produce products like vinyl chloride, which is a gas used to produce polyvinyl chloride (PVC). It was the start of the plastic age, and we had to make sure we had plenty of resources for future generations.

Coca-Cola is credited for spearheading the use and laying the foundations for LCA in the United States. They used this method to calculate the beverage container with the least environmental impact (Scientific Applications International Corporation 2006;

Curran 2017). The quantitative data was sourced through government documents and technical reports.

The oil crisis in the 1970s caused increase interest in these comprehensive studies on energy, which later shifted to waste management in the 1980s once the oil crisis was over. The methodology for LCAs began without a standardized criterion for calculating a product, service, or process. Critics argued there was not enough quantitative data or appropriate means to share results (Jensen et al. 1997). By 1991, a statement issued by eleven State Attorneys General in the U.S. denounced LCA results until there was a standardized methodology and consensus on how to promote the results non-deceptively (Curran 2017; Jensen et al. 1997). With added pressure from environmental organizations, LCA standards were developed into the International Standards Organization (ISO) in 1997 under ISO 14000 (Scientific Applications International Corporation 2006). Improvements to ISO 14040-14043, the specific designations for LCA, continued to ensure LCA is used correctly, but with some concerns still prevailing (Pryshlakivsky and Searcy 2013).

Today, ISO 14040+14044 seems to be the standard for LCA concepts because it provides stricter and unambiguous formulations (Klöpffer 2012), but not without controversy. Standardizing this useful tool at the international level has proven to have created its additional political complexity, as demonstrated by the feedback provided through literature reviews (Pryshlakivsky and Searcy 2013). Researchers still struggle to effectively include social aspects, or qualitative data, into LCAs, also known as social life cycle assessments (S-LCA; Venkatesh 2019). As Venkatesh (2019) demonstrates in their literature review of different industries in developing countries, there is a lack of

consensus on impact indicators, which some argue is due to a lack of global standards. In other words, ISO 14040+14044 does not account for the use of qualitative data or information on how calculations can impact the lives of non-Western developing countries.

For the general public, proponents of LCA had problems with communicating results involving complex calculations. The public often wants to know how their purchases impacted the Earth, in essence, their footprint, rather than read pages from reports filled with equations. That is why market-savvy and environmentally-conscious companies controlled how they advertised the results to reduce waste and create cleaner products. Coca-Cola was the first to use LCA to reduce plastic use in their bottles and a prime example (Curran 2017), followed by bottled water companies (e.g., Nestlé Waters North America 2020). Hence the need to protect the public from deceptive results, especially with LCA results comparing different foods as a means to affect public perception. However, “many LCA researchers are largely unaware of the usage of their work by policymakers and the wider public” (McAuliffe, Takahashi, and Lee 2020, 219). For example, Figure 1 in the first chapter demonstrates food comparisons; however, people do not eat one grape or one almond when compared to one head of lettuce. Yet, these LCA results were often used by the media and the public to persuade influence perceptions on an issue. For California, these data results were used to vilify almonds as water hogs and grapes as water savers during a drought.

Also, the functional units used to communicate results can vary among researchers, depending on their research goals. “The functional unit is a measure of the function of the studied system(s) and provides a reference to which the inputs and outputs

can be related, mainly for quantitative evaluations (economic and environmental evaluation). This enables comparison of different systems" (Jugy et al. 2016, 330-331). The definition for a functional unit should be precise and comparable enough, which makes defining a functional unit difficult. For example, McAuliffe, Takahashi, and Lee (2020) explains the complexity of food-based LCA studies that utilize functional units based on mass or volume instead of diet, which comes down to quality (nutritionally-rich food) over quantity (larger quantities of food) to mitigate environmental impact. Farmers can immediately act on results from functional units based on mass by adjusting farming practices, while diet and nutritionally-based LCA studies would require more intricate data to understand how farming practices impact the nutritional value of the food.

Nutritional value LCAs is a new field of study that currently lacks enough data to make accurate comparisons between diets (for example, plant-based diets to meat-based diets). Jones et al. (2016) suggests creating methodological frameworks to account for the dynamics of consumer behavior. However, McAuliffe, Takahashi, and Lee (2020, 217) suggest "it would be impractical for LCA experts to carry out consumption surveys as standard," because researchers would rely more on consumer's preferences rather than "textbook" recommendations. This statement reflects a greater need for anthropology into LCA studies to explain problems with "textbook" diet standards and how age, self- and national identity, and social constructs influence food consumption and perceptions of nutrition over time (e.g., nutritional anthropology, Klein and Watson 2016; Ulijaszek 2018; Messer 1984; anthropology of food, Mintz and Du Bois 2002; Mintz 1986), as I will discuss further later on.

For this study, I compare wine production and include the hospitality industry to demonstrate the environmental impact of the wine tourism industry as a whole. As a literature review of the wine industry by Ferrara and De Feo (2018) demonstrates, there is a wide variability in how system boundaries are defined and a shortage of availability of inventory data that is original and site-specific to the studies. Most LCA studies focused on Italy and other parts of Europe with only one U.S. study (Steenwerth et al. 2015) included in the literature review. In addition, New World wines are produced slightly differently from Old World wines (MacNeil 2015), and viticultural techniques (vineyard management) would depend on location, agricultural policies, and available resources, including labor. The functional unit of wine is often in 750mL units and 1 kg for grapes. In addition, there is limited data on the hospitality industry, with more LCA results on hotels (Filimonau et al. 2011; Thomas 2020) and few studies on the restaurant industry (Ganbavale 2018). Menus change, so LCA studies for restaurants will vary with food trends and availability.

The functional units used in this study are based on mass and volume, specifically 750 mL of wine and 1 kg of grapes. Typically, a bottle of wine offers approximately five five-ounce servings. Assuming that a couple can consume one bottle of wine, this functional unit works well for comparing against a one-night stay at a hotel in Temecula. Using literature review, I will discuss the environmental impacts, specifically water and carbon footprint, of producing wine to support a growing wine tourism industry.

Most Life Cycle Analyses focus on production resources and does not always include social impacts, such as the non-environmental effects on human labor (e.g., living wage), or even the effects of deceptive advertising. Also, a literature review on LCA's

history demonstrates how it is somewhat ahistorical with its “history” limited to changes to standards rather than the political events that may have stimulated the need for change. Literature reviews offer critiques on the limitations of a standard. However, they often do not cite real-world examples to explain why something needs to change. The focus is on the use of the method and not how the results affect people. This problem with LCA is where a Systems Dynamic model may play a better role.

Systems Dynamics

Systems Dynamics (SD) is an even more complex calculation than LCA because it considers behavior to understand industrial processes, policy analysis, and design (Forrester 1961, Sterman 2000). System Dynamics looks at a system as a whole to understand how people and objects interact in the system through stocks, flows, and feedback loops, and how changes in variables affect other variables over time (Systems Dynamics in Education Project 2020). A straightforward example is adjusting the temperature of water by touch and over time (feedback loop), then adjusting the hot and cold temperate (flow) on a water faucet to achieve the desired temperature (stock). It began with Jay Forrester, who injected his previous background in computer engineering (servomechanisms design) into management (control theory) to invent Systems Dynamics in 1956 while a professor at MIT Sloan School of Management (Forrester 1961; Sterman 2002).

According to Forrester (1995), Systems Dynamics began when General Electric wanted to understand why they had to lay off half their staff despite the plant running on three or four shifts a day. After Forrester reviewed inventory, hiring policies, employees,

and production, he revealed that there was employment instability due to decision-making policies. However, SD was not always well received at first. In his book, *Urban Dynamics* (1969), his models suggested that most major urban policies in the U.S. did not achieve positive results. He argued that the most damaging policy was building low-cost housing because it prevented commercial development, which created jobs for people. Yet, the low-cost housing drew more people into the city looking for work. “Building low-cost housing was a powerful process for *producing* poverty, not alleviating it” (Forrester 1995, 11; 1969). Municipalities have since moved away from these policies, but it took some time.

Since then, Sterman (2000, 2002) is known as the leading authority of SD. He argues that engineers need “to consider the social, political, ecological and other impacts of proposed technical problems,” and the inverse applies for social scientists about physical science and technology (Sterman 2002, 4). He cites nuclear power as an example of cheap energy at the expensive cost of safety, waste disposal, proliferation, and terrorism. Sterman specializes in policy resistance, which is when stakeholders resist the rules imposed on them. This resistance often arises not from lack of knowledge or tools, but because our mental models direct us to incorrect inferences on the dynamics of a system. This example is playing out as I write now with how people respond to wearing masks during the Covid-19 pandemic, reflecting their ideas of freedom, and understanding of the virus and herd immunity.

Sterman states that “models should be grounded in and tested against the widest array of data, including numerical data, archival information, and qualitative data gleaned from interviews, observation, and other ethnographic methods” (Sterman 2002, 14). He

is a proponent of participatory community research because it provides transparency of data collection and use. He suggests for the researcher to self-assess bias and understand the emic and etic perspective. He is implying that engineers become anthropologists rather than combine each discipline's strength by working with social scientists.

In my experience, this is a problem and unfair to the researcher trying to wear more than one hat, including myself. I worked on a personal project with engineers and biologists to understand the local community's response to implementing aquaponics systems in their lives. These results-oriented researchers were not trained in social science and conducted interviews and surveys to collect qualitative data. Their study concluded that more outreach education is needed (e.g., D.C. Adams et al. 2013), which seems to be the default answer. When I became involved, it soon became apparent that they were asking questions to reinforce their assumptions. As well-intentioned as they are, they could not have known their limitations until a social scientist became involved. You do not know what you do not know, yet Sterman asks engineers to do just that. As a result, SD modeling could be unintentionally reductionist due to the researcher's limitations to know what inputs to consider. The same can be true if an anthropologist conducts SD modeling, or LCAs, when not trained in these complicated system assessments.

Also, unless ethnographic data is available, databases are biased toward Western production even in an ethnically non-Western diverse community. For example, Rebs, Brandenburg, and Seuring (2019) conducted a literature review on SD modeling of supply chain management. They explained how including social dimensions is challenging,

especially in scales smaller than a regional area. They mentioned two challenges: accounting for diversity in a group and considering power dynamics between stakeholders based on their roles within the system. This dissertation reflects some of these challenges.

Limitations of the FEW Nexus

The nexus approach has several problems that prevent it from being a practical and holistic approach to resolving resource-use issues. First, the interrelationships are studied linearly and do not often consider the relationship each resource has with one another (Scott et al. 2011). In other words, the nexus assesses water to energy or energy to water, but not both simultaneously. For example, Gleick (1994) discussed water and energy production separately from water and energy consumption while demonstrating how the two are connected. Gleick's calculations provide a valuable tool. His article may have begun the conversation about water and energy, yet fails to place equal emphasis on human well-being as he does on ecosystems.

Second, a nexus approach may recapitulate the nature/society dichotomy. Resources can be perceived to fall into the nature realm, while the infrastructures designed to act upon the resources are part of society. The hydrologic cycle is one example discussed in this chapter. This dichotomy is hindering the creation of effective solutions and policies. Proponents of the nexus perspective argue for further inclusion of decision-makers to provide inputs of scale, environmental degradation, and social impacts (Bazilian et al. 2011; Scott et al. 2011). Also, these proponents recommend

policies that consider the interrelationship of multiple resources instead of just one (e.g., water policies, air policies; Bazilian et al. 2011; Scott et al. 2011; Kenway et al. 2011).

Interestingly, the authors calling for social inputs to nexus thinking included engineers as much as social scientists (e.g., Marsh 2008; Dale 2013). Kenway et al. (2011) explained that there is an abundant amount of studies on the environmental aspects of the nexus, but there is a lack of information on the economic implications. “This is a major gap considering the financial implications of water and energy linkages...There is an even bigger gap in studies which consider the social, political, legal dimensions of the nexus” (Kenway et al. 2011, 1987). The authors advise “the brave-hearted could consider such a study in the industrial or commercial arena” (Kenway et al. 2011, 1987), possibly suggesting to “study up” (Nader 1969).

Finally, the nexus in any particular context may depend on partial, Western-based perceptions of resource management to guide policy- and decision-makers (e.g., Linton and Budds 2014 on water). Thus, when implemented in non-Western settings, or on non-Western people, the nexus could result in changes to established social networks, redefine resources, and change the patterns of access, use, and control (e.g., for water, Johnston 1987; Johnston 1998; Budds 2009; Wagner 2013; for energy, Degani 2013; Strauss and Reeser 2013). These forms of data often are not included in resource production and consumption assessments. For example, Budds recommends more attention to the production of hydrological data to understand “the social power relations between environmental scientists, who generate information, and other actors, such as policymakers, who use it” (2009, 420). The same is true for energy. Rupp (2013) demonstrates how New Yorkers discuss energy as a cultural issue connected to magic

and faith and a technical substance based on science. Her research “suggests that different theories of science and magic – and different understandings of how science and other forces work in society – coexist and overlap without necessarily creating cognitive dissonance for ordinary people” (Rupp 2013, 93). This New York example also suggests that Western perceptions used in resource management may be limited to those of the “expert” – the scientist or engineer.

Even if there is a shift to SD to correct for the limitations of nexus metrics, like LCA, it is clear that it is still dependent on the skills of the research team. The nexus approach needs to include several disciplines' skillset rather than an interdisciplinary approach where one researcher or research team is wearing more hats than they are qualified to wear. Even with a transdisciplinary approach, there is still the issue of what theoretical perspectives to use to create the research question and guide data collecting, which is an additional bias.

Wine as a Food

People’s relationship with wine is an excellent example of how anthropology is needed in FEW nexus research. Whether wine can be defined as a food, much less food insecurity, to include in FEW nexus studies, seem to be entirely subjective, debated on, and steeped in history. How does an environmental scientist conduct a Life Cycle Analysis on a product based superficially on the concept of terroir? One definition of terroir is “the complete natural environment in which a particular wine is produced, including factors such as the soil, topography, and climate” (Oxford University Press 2020). However, Life Cycle Assessments conducted on wineries demonstrate that it is not as

simple as that (Christ and Burritt 2013; Pattara, Raggi, and Cichelli 2012). All these intricacies between nexus metrics, history, and laws are interconnected.

If there is one drink that can represent the attitudes of large geographic regions, it is wine. Anthropologists have studied wine worldwide as a constructive drink for trade, connecting identities, or producing performance or rituals, among its many uses (Douglas 2003; Black and Ulin 2013). The difference between Old World wines and New World wines is tradition versus science. Old World wines are made in Europe, the Mediterranean, and the Near East. These wines helped shape the cultures in those regions over the centuries. New World wines are made in the Americas, South Africa, Australia, and New Zealand. Wine grape varietals were introduced and improved for these new regions with science and the winemaker's artistry. The United States views wine differently, thereby affecting resource use and production techniques.

In the United States, wine production and distribution fall under a system of laws and regulations known as wine laws (Knaup 2010). These laws are governed by different levels of government (federal, state, and local). They can be categorized as law covering the following: (1) viticultural practices, (2) wine production, (3) international trade, and (4) wine marketing and distribution. Some of the federal government entities that regulate wine include the USDA (viticultural practices), the Food and Drug Administration (wine production), and the Treasury Department, or, more specifically, the Alcohol and Tobacco Trade and Tax Bureau (TTB; for international trade; wine marketing and distribution). The alcohol content of wine determines how much any given agency regulates the product.

Wine laws were partly influenced by Prohibition (1919-1933), which in turn may reflect society’s struggle to identify wine as food. Yet, by the early 21st century, the U.S.

Treasury Department approved for companies to add nutritional labels to alcoholic beverages voluntarily. This decision came after years of lobbying by consumers that want transparency about their foods, and hard liquor companies that want to advertise their product as low in calorie and carbohydrates to appeal to dieters (Associated Press 2013). Wineries carrying out this request to appease consumers may inadvertently change the perception of wine as food. However, wine can only be consumed by those over 21 years of age in the United States, which reduces the population that can consume this product. The cost would further reduce the people that can afford to drink wine. For example, at a restaurant, a glass of wine may start at $7. A bottle starts at $25 depending on the varietal, the winery, its appellation, and the restaurant. When one compares that cost to a gallon of milk (organic milk costs $5+), or a glass of tea at maybe $2, wine is not the most affordable food product, if it can be categorized as food.

According to U.S. law, food is defined as "(1) articles used for food or drink for man or other animals, (2) chewing gum, and (3) articles used for components of any such article" under 21 U.S. Code §321(f). Wine seems to fall in a gray area between different government departments, reflecting how people respond to wine. For example, data on the nutritional value of wine are available through the U.S. Department of Agriculture (USDA; Duffy 2009), yet some people would not identify wine as food. Other people argue for the beneficial health and social effects of food, with debates playing out to the general public on whether wine is healthy or not (i.e., functional foods, Yoo 2010; Ross 2000). My favorite is drinking a glass of red wine is like spending an hour at the gym (Sitch 2015). These social differences or relationships that people have with wine extend to how

vineyards and wineries are managed to achieve sustainable systems. As a result, environmental managers and scientists are requesting for more anthropological data.

In an integrative literature review of environmental assessments in wine production in Australia, Christ and Burritt (2013) demonstrated that few wineries collect environmental information. Those wineries that collect data are achieving limited success with some aspect of their environmental management, including water, chemical use, solid waste, energy use, or land use. They concluded that further research was needed on the type and application of environmental information by wineries. They also request the inclusion of social impacts into environmental research to capture a holistic view of "sustainable action." From their literature review, they could observe that "wine culture" in different wine regions, including concepts of terroir and attitudes towards collecting environmental data, "affects actions impacting on the physical environment, as well as the overall level of environmental activity and response" (Christ and Burritt 2013, 240). Although Christ and Burritt's study was conducted in Australia, regional differences in wine production and a lack of environmental data are challenges worldwide (e.g., Pattara, Raggi, and Cichelli 2012; Rinaldi et al. 2016; Steenwerth et al. 2015). Limit of data is also demonstrated in the hospitality sector (See Table 1; Filimonau et al. 2011; Pongchavalit 2016; Thomas 2020; Ganbavale 2018).

This dissertation research addresses people's perspective of resources, including how they collect data and manage resources along with their response or "sustainable action," especially during resource scarcity (drought). Because wine's definition as food varies, this study uses the U.S. legal description as a starting point to define wine as a

Table 1. Brief literature review on nexus metrics for wine and hospitality industry.

Authors	Region Inputs	Sector	Assessment	Energy (MJ and GHG)	Water
Pattara, Raggi, and Cichelli 2012	Italy	Wine	Wine Supply Chain comparing cradle to grave LCA to Carbon Footprint (CF) tool	LCA - 0.775 kg CO_{2eq}/bottle	N/A
				CF -1.290 kg CO_{2eq}/bottle	N/A
Rinaldi et al. 2016	Umbria, Italy	Wine	Water and Carbon Footprint of Wine - cradle to grave LCA	Red wine - 1.443 kg CO_{2eq}/bottle	Red wine - 504.1 L / bottle
				White wine - 1.377 kg CO_{2eq}/bottle	White wine - 551.0 L/bottle
Steenwerth et al. 2015	California	Vineyards	GHG, energy ,and water assessment of wine grape production	Napa - 6529 MJ/metric ton, 456 kg CO_{2eq}/metric ton	265 m^3/metric ton of grapes
				Lodi - 2759 MJ/metric ton, 203 kg CO_{2eq}/metric ton	141 m^3/metric ton of grapes
Ganbavale 2018	New York	Restaurants	LCA - Carbon footprint of restaurant menu	35.63 metric tonnes kg CO_{2eq}/month	N/A
Thomas 2020	California	Hotels	Hotel Water Measurement Initiative assessment tool	N/A	Mean 503.38L (*sd*=318.21, *n*=372) a day, or 132.98 gallons (*sd*=84.06) a day, per occupied room
Pongchavalit 2014	Thailand	Hotels	Carbon footprint for small to medium hotels	18.81 kg CO_{2eq}/per room per night	N/A
Filimonau et al. 2011	Global	Hotels	Carbon footprint of hotels	average 14.08 kg CO_{2eq}/per room per night for UK	N/A

drink that is consumed by humans as or with food, and as a crop that shares the same values and resources (water and energy) as other crops grown for human consumption. Legal descriptions and laws reflect the cultural utility of wine and are one method to compare attitudes about wine as food by other states and countries. The ethnographic research will capture wine's local beliefs and management as food from Temecula Valley Wine Country.

Anthropological Approach to the FEW Nexus

So how do anthropologists study the FEW nexus? For several decades, anthropologists have used different approaches to study how water, energy, and food have impacted society. They came to the consensus that there is not a single solution that can be used globally (Orlove and Caton 2010; Strauss, Rupp, and Love 2013). However, anthropologists still face the challenge of understanding how food, energy, and water connect different sectors of society. The inspiration for this study began with *The Social Life of Water* by John R. Wagner (2013), which provides a glimpse of the complexity of human relationships towards resources. For this book, Wagner used a variation of Appadurai's (1986) *The Social Life of Things,* which describes how studying an object's exchange through society, explains its social context. Contributors to Wagner's book demonstrate how water acquires value within a cultural context. However, Wagner argues that water also demonstrates agency, not necessarily with intentionality but in ecological terms where it has the power to create or remove inequality. For example, Veeravalli (2013) demonstrates how rainfall fluctuations remove inequalities. In East Africa, rich people collect water in storage tanks during the rainy season. However,

during the dry season, they are forced to collect water like everyone else. So how can the anthropomorphized and political life of one or more resources be incorporated with nexus metrics?

To study the anthropology of water, Orlove and Caton (2010) propose Mauss's (1990) concept of "total social fact," which used to refer to "service exchanges." Mauss explains "total social fact" as social phenomena that are given personal and political expressions, while at the same time holding economic ones. Strang (2004) refers to this same concept as the "essentiality" of water, which shifts the reduction of water as a biological fact to one that is integral to society. From their extensive review of the anthropology on water, Orlove and Caton (2010) summarize five themes central to the study of water, which are themes that could also extend to energy and food: value, equity, governance, politics, and knowledge. The challenge is to study how people respond to each resource and their interrelationship with these themes when there is no theoretical road map to guide an anthropologist in FEW nexus research.

In contrast to the study of water, anthropologists have studied food from different perspectives (Mintz and Du Bois 2002). From taboos on food and drink (Douglas 2003) to how food shapes society (e.g., sugar - Mintz 1986; chocolate - Coe and Coe 1996; McNeil 2006; maize - Eubanks 2001) and in turn, society shapes food and its access (e.g., sacred cows – Harris 1978; food security - Himmelgreen and Romero-Daza 2010). Mintz (1986) provides a colonialist history of sugar that demonstrates its rise to power on Western society. He states that cultural and historical context influences how we link objects with events and give them meaning. His focus was on the production and consumption of sugar, where Mintz identifies a dichotomous relationship of power.

“Intensification” as those with the power to present a product and define its meaning. In contrast, “extensification” where those in power control the availability of the product, but consumers decide its meaning. He demonstrates how these power relationships can shift from one to another over time, such as how sugar shifts from a luxury good to a product that is added to almost everything we eat, especially with foods for special occasions, like weddings or Christmas.

Society also shapes people’s access to food. In 2006, the USDA decided to replace the word “hunger” with “low food security” in official policy statements (Himmelgreen and Romero-Daza 2010). Himmelgreen and Romero-Daza (2010) examine how this change could affect federal policies for food assistance services, and the public’s perception and attitudes toward this issue, even though the word is technically invalid. They provide an overview of policies and research that explains how “hunger” has been defined and conceptualized to demonstrate the power this word has in improving food insecurity. For example, people are dedicated to ending hunger, so removing the word from political and public discussion may send the message that there is less of a problem. The authors end the article by providing suggestions on moving forward, like reconceptualizing hunger to include multiple parts of this issue, including the layman’s point of view.

However, there is still the matter of studying food as part of the FEW nexus, where it leaves out another resource or places less importance. For example, Marvin Harris (1978) wrote about the sacredness of the cow in India. He compared it as a source of energy from providing calories (energy) through the consumption of dairy products (food) to using dung as fuel (energy) to using oxen in their agricultural system (more energy).

He mentioned that during a drought, a cow would stop lactating, which causes hardship to the people who sacrificed their livelihood to keep the cow alive until it produced again. However, Marvin and Mintz never delved into water scarcity as part of this sacredness or power of resources. Even recently, Simms (2013) mentioned in his research on water use in wine production of the importance of studying energy but admitted it was outside the scope of his research. This limitation does not reduce its contribution to anthropology. Still, it reflects the focus we, as researchers, place on resources, the boundaries of theoretical frameworks, and possibly on our actions and biases as human beings.

For example, energy is rarely discussed in this same way as water or food, yet food is a source of energy (e.g., Rupp 2013; Nader 1969; White 1943). Instead, scholars focus on the political economy of energy production or conflicts between expert and lay knowledge (e.g., Strauss et al. 2013; Nader 2010). One explanation may be due to so many different forms of energy that can be viewed and related to differently (e.g., kinetic, magnetic, electric). At the same time, water can have various forms but have similar recognizable physical compositions.

Leslie White (1943) was an anthropologist known for studying energy and how it helped shape society. He provided an equation to calculate the amount of energy and technology used to produce a product that could advance human culture (ET=P). Energy per capita per year multiplied by efficiency-providing Technology equals a Product that provides cultural development, also known as cultural evolution. To best understand White, one would have to know that his father was a civil engineer, which may have influenced his quantified approach to cultural evolution. His argument was like an anthropological life cycle analysis. The intensity of energy use by a homogenized

collective of people determined the growth and complexity of culture. White also reflects the problem of causality when quantifying culture (Nader and Beckerman 1978). Cultural evolution is criticized for being determinist. These early studies were on a top-down, national, and global level (White 1943; R.N. Adams 1975) because energy use at this scale determines society's growth while dismissing the contributions of local events. "Global theorists of cultural evolution are pertinent because of the clear dangers of putting too much stock in a local and short term experience" (Nader and Beckerman 1978, 10). Nader and Beckerman use local, in this sense, as the national scale. For example, the United States use of energy per capita versus quality of life. Nader and Beckerman (1978) point to periods when increased energy has improved the quality of life in one period while reducing it in another. They suggest that these correlations are related to each other but are more complex than those provided by theorists like Cottrell, White, Adams, and Odum.

Today, anthropologists take a feminist and applied perspective to study energy. One anthropologist that leads this new perspective on energy studies is Laura Nader (2010, 1996; National Research Council 1980), who began her career during the energy crisis of the 1970s, almost parallel to LCA development. She understood that people with higher power controlled the narrative over energy, yet this was a segment of the population that could hide faceless behind corporations, making them difficult to access. She coined the term "studying up" (Nader 1969) to study the people who are creating and enforcing energy policies to understand the power dynamics that affect people living under those policies. Nader held high positions, which gave her access to these influential energy stakeholders.

As part of the Committee on Nuclear and Alternative Energy Systems of the National Research Council, Nader produced a report title *Energy Choices in a Democratic Society* (National Research Council 1980). She was part of a transdisciplinary group of physicists, economists, and anthropologists that conducted a study between 1976-1977 on life under different energy conditions. The researchers intended to explain against the notion that using less fuel would equate to going back to the stone age, the opposite of what White (1943) proposed and may have reinforced. The researchers suggested that energy policies need to be flexible to allow future generations to go in a different direction. Some examples are something as small as using energy-saving appliances in a home to incorporating small heating plants at a district level capable of heating apartment buildings while the “waste” heat is used to heat water. The report was presented in 1980, causing much controversy, which may have prevented the study from meeting its goal to create U.S. energy policies at that time. Instead, people were policy resistant and dropped the topic of making national energy policy on the heels of the Presidential election of Ronald Reagan in the fall of 1980.

Anthropologists, like Nader (2010) and Strauss et al. (2013), provide collections of ethnographies on the history of the anthropology of energy and examples of how energy studies have changed since White (1943). These ethnographies include how energy is managed in non-Western settings, or among indigenous people, like Chapman’s (2013) study of how the ontology of energy played a role in negotiating oil and gas resources by indigenous people in the Yukon Flats, Alaska. In addition, disciplines, like Public Health, also reflect how gender can play a role in the FEW nexus. Although the case studies presented in a WHO report present each resource separately, common themes occur for

some women living in parts of Africa (Sims, Global Environmental Epidemiology Network, and World Health Organization 1994). For example, women's health and safety are connected to fuel use. Women and children are often tasked to collect firewood to cook food. Cash crops reduced the forests that women depend on for fuelwood, forcing families to either pay more for fuel, like kerosene, or invest a woman's time, energy, and safety on collecting fuelwood. Still, based on White and Adams, a resource like firewood may not be considered nation- or technology-building energy resources, even though forest degradation can contribute to reduced water quality (Neary, Ice, and Jackson 2009) and quality of life (Sims, Global Environmental Epidemiology Network, and World Health Organization 1994), thus hindering the growth of a healthy people and national economy.

Hydrosocial Cycle

One possible approach to understanding our interrelationship with resources is the hydrosocial cycle, which emerged from social science as a method (possibly theory) to understand how people socialized with water (Budds 2009; Linton and Budds 2014; Kane and Brisman 2014). In this research, I use it as a method that may promise to be a good foundation for future FEW nexus theory. This new inductive approach causes people to dispute whether it could be labeled theory. Still, its flexibility offers the inclusion of multiple resources and could reduce bias by the researcher. The hydrosocial cycle was introduced at the turn of the 21st century. However, its production can be traced to the study and management of water in the 20th century (Linton 2007, 2008, 2010). It was beginning with the emergence of the field of hydrology (Linton and Budds 2014). American hydrologist, Robert Horton, proposed the hydrology cycle. It describes the hydrologic

process and helps legitimize technical authority over water (Linton and Budds 2014). The Horton's hydrology, or water, cycle is still taught today to elementary school children (see Figure 3). It is explained as rain falling from the sky where it either evaporates back to the sky or soaks into the earth to replenish plants and aquifers with any excess flowing to rivers, streams, and oceans. This process is performed without human interruption and supports the nature/society dichotomy (Schmidt 2014).

It is around the turn of the 20th century that water is "officially" labeled a resource. Linton (2007, 2010) argues that geologist and anthropologist William J. McGee may have started our social disconnection with water. In his paper titled "Water as a Resource" (1909), McGee suggests that water is something to be controlled by humans. McGee states, "The conquest [of nature] will not be complete until these waters are brought under complete control" (McGee 1909, 522-523). According to Linton, it was at this point that

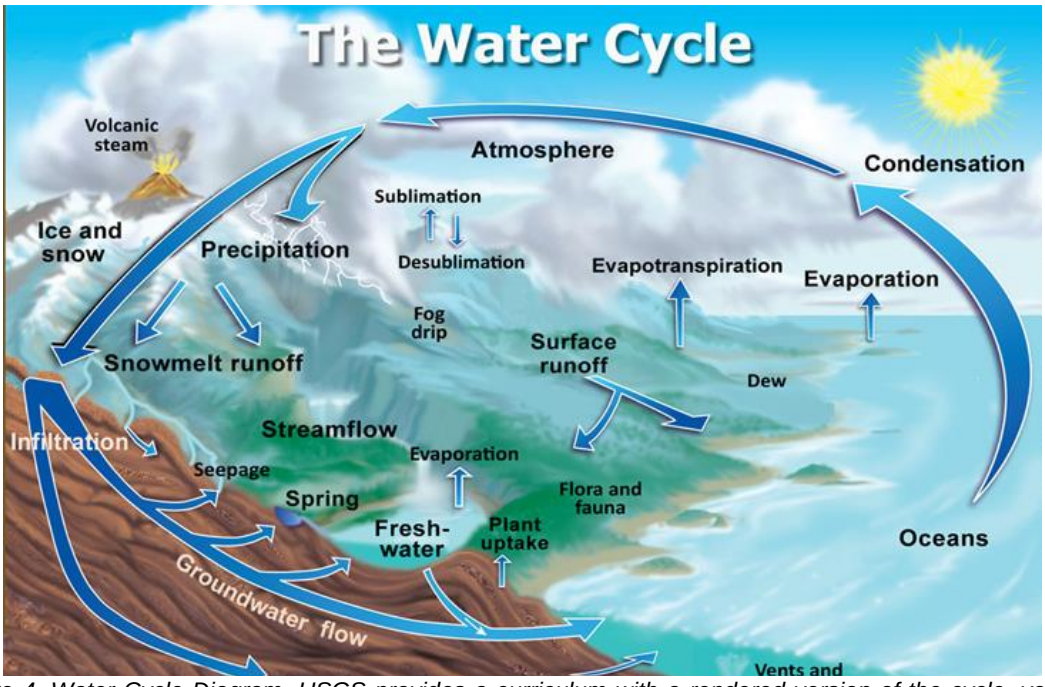

Figure 4. Water Cycle Diagram. USGS provides a curriculum with a rendered version of the cycle, yet still without human interference. Reprinted from USGS, by Howard Perlman and John Evans, https://www.usgs.gov/special-topic/water-science-school/science/water-cycle?qt-science_center_objects=0#qt-science_center_objects. Public domain.

water became an “object of calculation and subject to a particular kind of accounting and manipulation, which for McGee and his contemporaries was signified by declaring it a resource” (2010,151). This shift to government control over water continued in the United States throughout the 20th century, thus reducing water to the material and quantifiable composition of H_2O (Linton 2010).

In contrast, Schmidt (2014) argues that McGee also allowed for water’s agency to be included in policy-making and that the hydrosocial cycle overlooks non-human agency. He states that McGee and his contemporaries viewed water as “the bridge between life and non-life and H_2O was seen as the active agent in the evolution of societies and institutions” (Schmidt 2014, 223). Schmidt continues to place the actions of McGee and his contemporaries in the proper historical context, as a form of vitalism that was becoming popular at the time, which in his view “legitimated the development and management of watersheds in support of the American people” (Schmidt 2014, 231). However, the make-up of the American people was barely discussed by either author. Their arguments could have been enhanced by including how the field of hydrology and the passing of water conservation laws impacted Native Americans and other non-white ethnic groups in the United States. Linton’s arguments about McGee were ethnocentric and, although Schmidt called him out on this, he did not offer evidence to suggest that McGee was not also guilty of the same thing as well.

The hydrologic cycle continued to dominate how policy- and decision-makers managed and conserved water. It was not until the 1990s that water resource managers sought to integrate hydrology with society by including relevant stakeholders in decision making. However, water was still regarded as separate from society and something to be

controlled. Thus, water management is transformed into water governance (Linton and Budds 2014).

> Water governance is defined by the political, social, economic and administrative systems that are in place, and which directly or indirectly affect the use, development, and management of water resources and the delivery of water service... at different levels of society. Importantly, the water sector is a part of broader social, political, and economic developments and is thus also affected by decisions outside of the water sector. (United Nations Development Programme 2014)

This definition by the United Nations Development Programme (UNDP) was removed from its website by 2020. However, their definition demonstrates continued support of government control over water, despite stakeholder involvement. Managers of water governance cannot assume that those involved share the same values, or that stakeholder involvement results in agreement among all groups (Orlove and Caton 2010; Mcneish 2006; Wells et al. 2016). Stakeholders' relationship with water could come at odds with water resource managers' indoctrination. There are several examples of how differences in worldviews could pose a challenge. Bear and Bull (2011) introduced several articles that demonstrate how people characterize water and how that depiction shapes society. Water is described as "unruly" (P. Jones and Macdonald 2007), or water is active in tales of masculinity (Bull 2009) or engaged in interspecies relationships (e.g., fishing; Eden and Bear 2011; Bear and Bull 2011). These articles support arguments that the hydrosocial cycle joins nature with society as components that are related internally (joined) rather than externally (separated) to one another (Swyngedouw 2009). Thereby, the relationships between water and society "make and remake each other over space and time" (Linton and Budds 2014, 1).

Anthropologists Kane and Brisman (2014) suggest that the hydrosocial cycle may reveal truths about human-environmental (in)justice and conflict. They argue that this approach, or paradigm, could “ground the study of climate change” and increase people’s involvement in environmental issues. The relation-dialectic method used in the hydrosocial cycle is what makes Linton (2010) a tremendous advocate for this approach. Linton was influenced by geographer David Harvey who took a Marxian approach to critique the spatial dimensions of capitalism, which he referred to as historical-geographical materialism (Castree and Gregory 2006). This approach explains how the course of history and the production of space are consequences of capital accumulation (Castree and Gregory 2006; historical ecology, Balée 2006). Harvey has since incorporated some Foucauldian concepts, such as the power of discourse, into his version of historical-geographical materialism. Discourse is how we think and communicate about ideas, things, and people. The power of discourse is when an institution legitimizes certain types of knowledge, while actively excluding others.

Linton (2010) argues that he moves even further beyond Harvey’s approach to include how ideas play an essential role in the human and non-human processes that produce water and history. Linton explains that relational – dialectic analysis considers how two separate and independent things, or moments, actually produce each other. Linton views water as a moment in this explanation, what he has coined hydrolectics. He continues to state, “water is not a [biophysical] thing but, rather, is a process of engagement, made identifiable by water’s emergent properties but always taking form in relation to the entities with which it engages” (2010, 30). Linton suggests that there is a great deal of ourselves found in water. He echoes Cronon’s (1995) description of nature,

where he states, “the way we describe and understand [the] world is so entangled with our own values and assumptions that the two can never be fully separated. What we mean when we use the word “nature” says as much about ourselves as about the things we label with that word” (1995, 24). It is this concept about how things are embedded in society that attracts me to the hydrosocial cycle approach.

Budds (2009, 428) uses the hydrosocial cycle to understand water resource management in Chile as an entry point “to reveal the power relations that intersect the biophysical dynamics to produce and reproduce political ecologies.” Swyngendouw (2009, 57) further notes that “it will be vital to examine how hydro-social transformations are imbedded in and infused by class, gender, ethnic, or other power struggles.” These authors suggest that the hydrosocial cycle could serve as a framework or methodology for the political economy or ecology of water, which would then better reveal the power relations over a resource. Ridolfi (2014) also came to the same conclusion with her analysis of the urban political ecology of tourism and water. However, a summary of hydrosocial cycle studies by Ridolfi (2014) reveals that the disciplinary approach used in these studies are almost entirely within political ecology.

For this study, I am taking a political ecology approach (discussed below) because, if done well, I should give equal focus on the resource in question by recognizing its agency in society (e.g.,Budds 2009; Swyngedouw 2009; Robbins 2012). However, Budds (2009) demonstrates how political ecology reduces the social-resource relationship into a linear relationship of cause and effect, focusing on the political aspects. Causality is the critique made towards the water-energy nexus, and White’s cultural evolution. Budds (2009) argues that increasing the ecological perspective in the social-resource

relationship may not balance a political ecology approach because the environmental science used to understand the resource is shaped by Western concepts, which is demonstrated by the use of the hydrologic cycle. These are important points to consider with any theoretical approach. Therefore, Budds (2009) recommends the hydrosocial cycle as a framework that allows water to be studied as a resource embedded in society rather than outside of social relations.

To study the FEW Nexus with this approach, the hydrosocial cycle needs to include energy and food, which is a combination that has not been explored in the past by social scientists. Although the hydrosocial cycle focuses on the social aspects of water, it may face some of the same issues of linearity as the water-energy nexus. For example, social scientists study the effects of dam projects on water and local residents but do not discuss the energy production aspect of the project along with it (e.g., Strang 2013; Mehta 2013). Nevertheless, this inductive and relation-dialect approach gives the flexibility to explore the interrelationships of resources to understand wine and wine tourism production and sustainability.

My initial interest in using the hydrosocial cycle in my research is to include “resource” agency with a spatial component, because water and energy may be physically delineated in Temecula Valley. For example, people in the valley have access to water from the local water district. In contrast, people in the periphery and outside the Temecula Valley AVA may not have access to municipal water and depend on wells. I expect that the relationships that inhabitants have with resources in different areas will vary spatially among socio-economic, gender, and ethnic groups. So, understanding the interrelationships of water, energy, and society needs a social, as well as a geographical

context. Kane and Brisman (2014) suggest following the flow of water, but water could take several paths. This challenge is where systems thinking has advantages to provide boundaries.

Systems Thinking

An approach similar to the hydrosocial cycle is systems theory, sometimes referred to as systems thinking. I discussed its use in LCA and SD modeling, and there are similarities in anthropology. In the social sciences, this theory has roots in Marxian historical materialism, where changes in development and society are caused by the things people produce over time (Marx and Engels 1970 [1846]). These changes are studied in their context, as part of a system, to understand interactions occurring around a phenomenon, referred to as feedback loops in cybernetics (Hammond 1997). Feedback concepts can be traced back to Hippocrates, but what was "the most significant innovation [of cybernetics] was the linking of the concepts of purpose and goal-directed activity across biological, technological, and social systems" (Hammond 1997, 67; Heims 1991). In anthropology, Gregory Bateson incorporated cybernetics to aid anthropologists in the study of social systems, advocating for systems theory in the discipline. He states that "the basic rule of systems theory is that, if you want to understand some phenomenon or appearance, you must consider that phenomenon within the context of all completed circuits which are relevant to it" (Bateson 1991, 260). Systems theory or systems thinking offers the opportunity to identify a system and study the interconnection between food, energy, water, and society across disciplines.

However, systems thinking has several problems. For one, researchers assume negative and positive feedbacks self-correct or self-reinforce aspects of behavior. Also, systems thinking focuses on the internal causes of behavior rather than understanding external causes manipulating behavior (Hammonds 1997). Richardson (1991) explains that policies based on linear models and implemented on nonlinear systems may cause unexpected or exacerbate problems the policy was trying to solve. This problem is one of the critical issues with the water-energy nexus. Also, Hammond suggests that the feedback concept used in the social sciences "reinforces a machine view of nature" (Hammonds 1997, 80) and places control over the system to systems scientists, implying that the scientists are creating the system, in essence, themselves.

Furthermore, scientists have to decide on a model (Gouldner 1973). "[M]ost systems models are based on assumptions of interdependence between the parts of the system and an inherent tendency for these parts to maintain equilibrium in their relationships, although.... equilibrium does not always result from interdependence" (Hammond 1997, 109; discussing Parsons 1951). Finally, Kramer and de Smit (1977, v) indicate that there is "no generally accepted, clearly defined body of knowledge concerning systems thinking." They suggest that the array of systems approaches is reflected in the diversity of terms, such as systems theory, systems thinking, systems engineering. These terms draw upon various fields of knowledge, which sometimes overlap or contradict one another (Hammonds 1997). This diversity of terms and models is an issue I came across with nexus metrics when trying to visualize anthropology's contribution.

To summarize, the issues with systems thinking in the social sciences are (1) what to include in the system, (2) what models to use, (3) who is making these decisions, and (4) what is that scientist's bias, which leads to the results and means that (5) the model outputs are only as good as the data used to build and validate the model. Although systems thinking benefits from a multidisciplinary approach of taking the same relation-dialectic approach offered by the hydrosocial cycle, it does not reflect on the partiality of the (Western-based) science and may downplay individual agency, and completely exclude the agency of non-human resources. However, the concept of creating some boundaries for the research can create a manageable study to identify the interdependence in relationships; in other words, identify circuits despite issues with researcher bias.

Political Ecology

Political ecology does not have one clear definition to explain precisely this study of how society, politics, and economics affecting environmental issues and changes. The fluidity of this definition reflects on the inclusiveness of this approach. Robbins (2012, 1) describes political ecology as a remarkable synthesis of a number of independent trains of thoughts. The term became popular around the 1970s when used among several commentators (Paulson, Gezon, and Watts 2003). One of these critics was anthropologist Eric Wolf who first used the term political ecology "in its neo-Marxist sense… to signify the study of how power relations mediate human–environment relations" (Biersack 2006, 3). Wolf (1972, 202) mentioned a "need to view local life in a dialectical relationship with the larger man-made [sic] environment" to consider how the global affects the local.

Political ecology was produced from a combination of political economy and cultural ecology (Biersack 2006; Paulson, Gezon, and Watts 2003), and was first used to address the socioeconomic role and contributions of people in developing countries (Wolf 1982). Political economy and cultural ecology use a Marxian historical materialism approach with slight difference in focus in relation to the environment. Political economy explains "the relationships of the economic system and its institutions to the rest of society and social development" (Riddell, Schackelford, and Stamos 1998; in Sackrey, Schneider, and Knoedler 2008, vii). Also, it explains how they are historical and always changing (Robbins 2012). For example, how, over time, the material shapes society and society reshape the material. In contrast, cultural ecology is studying human adaptions to social and physical environments (Steward 1972). For example, people change their physical landscape and, in turn, the landscape changes or influences their culture. Balée (2006) presented a historical ecology approach, which studies human-induced landscape transformations over time, as a means to find the authentic. However, it is highly controversial approach since it seeks the authentic or "pristine," but pristine for who and why. For example, Sheridan (2007) discusses tensions between conservationists seeking the "pristine" and ranchers trying to make a living on public lands. Geographers and anthropologists were shifting to approaches that included the natural world we live. However, this shift to include the environment was not necessarily a new concept, as demonstrated with the development of the hydrosocial cycle.

Frank Thone (1935) is cited as the first person to coin the term in his article on the political ecology of grass, or pasture, used for grazing by Native Americans hunters and Mongolians herders, which was later converted to farmland by American immigrants and

the Japanese. However, Thone never used the term in the article. Robbins (2012) argues that the text makes the political ecologist. In that case, Robbins believes Peter Kropotkin (1888) was the first because his work challenged the laissez-faire social system of the time by explaining the mutual relationship humans have with nature and demonstrated the dangers of reductionist thinking. It does not matter who said it first, but this indicates that the concept of political ecology has been around for quite some time to explain people's response to environmental issues.

Over the years, scholars have independently moved towards political ecology, resulting in slightly varying definitions (Robbins 2012, 15-16; e.g., Cockburn and Ridgeway 1979; Blaikie and Brookfield 1987; Greenberg and Park 1994; Peet and Watts 1996; Hempel 1996; Watts 2000; Stott and Sullivan 2000). Robbins (2012) summarizes these definitions into four categories to demonstrates the function of political ecology. First, it explains connections in the condition and change of social-environmental systems, considering power relations. Second, it searches for causes of problems to uncover better solutions that are less coercive, less exploitative, and more "sustainable." Third, it understands that ecological systems are political, and society's views of them are shaped by political and economic processes. Finally, political ecology traces the history of narratives and power relations supporting that narrative (Stott and Sullivan 2000). Bryant and Bailey (1997) have suggested that political ecology research shares some common qualities that follow three assumptions: (1) there are costs and benefits to environmental changes, which are unequally distributed, (2) the unequal distribution reinforces or reduces existing socioeconomic inequalities, which (3) holds political implications in terms of the altered power of one actor over another.

However, political ecology has come under several critiques. First, political ecology focuses too much on the politics at the expense of the environment rather than having a balanced approach (Vayda and Walters 1999; Budds 2009). Vayda and Walters (1999) suggest that political ecology should concentrate on an environmental event and less on the politics to explain inductively the cause and effects of the event, which they have coined "event ecology." Peter Walker (2005) discussed this debate about how much of the environment is included in political ecology and quotes Watts (2003) from an unpublished manuscript. Watts disputes Vayda and Walters's argument because he believes that political ecology is defining the environment to include knowledge and representation along with the biophysical environment. Watts is trying to address the question of what constitutes environment and ecology and argues that Vayda and Walters reduce it into "biophysical events of environmental change... But political ecology rests on the dialectical and non-linear relations between Nature and Society in which environment can be approached in a number of ways" (2003, 8-9). Walker (2005) states that although Vayda and Walters may have addressed a legitimate concern over the lack of attention over biophysical ecology, adversarial bickering over a field meant to be "broad, inclusive, and integrative" does not further the overall goal of political ecology. The same could be said to proponents of the hydrosocial cycle, namely Linton (2010) and Budds (2009).

Another critique is that political ecology is not theoretical enough; thus, it cannot be called a framework or an approach, although I am referring to it as such in this document. Therefore, Robbins (2012) has decided to call political ecology a text. He explains that sometimes researchers may not seek to take a political ecology approach

but still produce research that highlights the political ecology of an issue (e.g., Kropotkin 1888; Thone 1935). He argues that there are five main themes that political ecology addresses: (1) environmental degradation and marginalization, (2) conservation and control, (3) environmental conflict, (4) environmental subjects and identities, and (5) political objects and actors.

Interaction with material objects has always been included in all the approaches discussed in this chapter. Political ecology has only recently taken a poststructuralist turn to allow non-human agency to come to the forefront (Orr, Lansing, and Dove 2015; multispecies ethnography, Kirksey and Helmreich 2010). Much of this has derived from the deconstruction of “what is nature” and the increased integration of the “natural” with technology (e.g., cloning, nano-bio technologies, Escobar 1999). Escobar names this human integration with nature that includes interaction between the organic and social actors as a hybridization (i.e., agroforestry, ecotourism, Escobar 1999; hydrosocial cycle, Swyngendouw 2009). Escobar (1999) argues that we need a more political understanding of hybridization, but the question is whether this can be done without marginalizing the biological. According to Ingold (1990), anthropology and biology's relationship requires a paradigm shift in biology. By focusing on the organism, we can recontextualize “the anthropology of persons within a biology of organisms” (as explained in Escobar 1999, 14-15).

Recently, even emotions have been included in political ecology, which fits nicely in this research when tackling socially-constructed definitions of terroir. Farhana Sultana (2015) coined the term ‘emotional political ecology’ to account for people’s emotional response to environmental conflicts. This approach combines feminist political ecology,

resource management, and emotional geographies to explain people's conflicting emotions with resource management.

Political ecology is so inclusive and diverse that it has an identity crisis, but this may be a reflection of humans' need to define and categorize their observations. The main goal of political ecology is to include everyone's voice to understand the interrelationships of politics, the economy, and the environment. Political ecology also demonstrates how the effects and perceptions of environmental issues and changes are unevenly distributed, affecting some members within and outside a group differently. Despite the bickering occurring at the turn of the 21st century, this approach allows to further advance the understanding environmental issues and changes.

Theoretical Framework of this Study

I presented four different approaches used among multiple disciplines to understand relationships between food, water, energy, and society: FEW nexus, hydrosocial cycle, systems thinking, and political ecology. Most approaches had their beginnings in Marxian historical materialism to understand dynamic relationships, which views how an object is in a constant state of being shaped by society and in returning shaping culture. Each discipline had their own, slightly different interpretations. This variation created a small dilemma within and across disciplines, resulting in some approaches lacking information and theoretical frameworks. However, this dilemma may reflect more on the scientists that need standardization than on the science seeking answers.

All four approaches have their inadequacies. The most ambiguous approach is the FEW nexus because it is a new concept that focuses on metabolism with limited emphasis on the social aspects of the nexus. This limitation is due to the quantitative nature of the nexus from the use of most models, like LCAs, which makes it challenging to incorporate qualitative data before projects are approved and implemented by a community. FEW Nexus approach also looks at resource use linearly, focusing on one resource in a relationship over another rather than simultaneously. An alternative model is Systems Dynamics, which includes ethnographic data, but depends on the researchers to understand the political connections and implications of resources. However, this approach may also open an opportunity for anthropologists to help incorporate qualitative data, such as power relations, local beliefs, and gender, into nexus metrics.

In contrast, a hydrosocial cycle approach attempts to include social-water interrelationships by understanding how water is embedded in society. However, it also lacks a clear and original framework – borrowing most concepts from political ecology and political economy. Also, the hydrosocial cycle has to extend to energy for this research, and multi-resource relationships has been overlooked. For example, studies of the social and environmental impacts of hydroelectric dam projects provide apparent connections.

Systems thinking offers the interconnection of different ecosystems and a multidisciplinary approach, but it also runs the risk of creating boundaries. The main concern is who creates the boundaries and whether that reflects the researcher's worldview, which may unintentionally exclude the input of other perspectives. Out of the four approaches, political ecology is the most grounded in time and practice. Maybe the

nebulous middle ground of political ecology has allowed this approach to be used in several situations by different disciplines since it is meant to be broad and inclusive. Political ecology can provide a balance over power relations, knowledge production, historical narrative, and nonhuman agency, to name a few. It also offers an opportunity for applied anthropological research because the goal for political ecology is to reveal the reasons for uneven resource access that could lead to solutions (Robbins 2012).

Since a theoretical approach for the FEW nexus in anthropology has not been tested or developed, for this study I decided to take a political ecology approach with a poststructuralist and feminist stance to include non-human agency. I cannot disregard how this approach evolved out of political economy, which offers a relational-dialectic approach that is important in understanding interrelationships. Linton and Budds (2014, 1) “define and mobilize the hydrosocial cycle as a socio-natural process by which water and society make and remake each other over space and time.” However, this research will demonstrate how non-human agency plays a part in that social construction. The only difference is that the hydrosocial cycle uses water as a vehicle for the researcher to transport through society without expecting specific results (i.e., labor conflicts). Since water flows diverge and could cause a loss of focus of the study, incorporating boundary limits of the research site, as used in a system thinking approach, will help identify its actors and resources, in essence identifying circuits.

Therefore, I define my political ecology approach of the FEW Nexus as a study of how people respond to policies, economies, society, and non-human actors when facing environmental issues and changes that affect multiple resources. I use this approach by incorporating the strengths of systems thinking and the hydrosocial cycle, as well as

consider how perceptions of the environment and non-human environmental actors affect resource management.

Chapter Summary

This chapter explained the Food, Energy, and Water Nexus and the demand by scientists, engineers, and policymakers for more anthropological data in nexus metrics, including in the wine industry. This research will demonstrate people's interrelationships with food, energy, and water associated with Temecula Valley's wine and wine tourism industry. The results will reveal contradictions and biases in how people view these resources, and how people's perceptions ultimately shape production, environmental management, and policies. Specifically, this study will observe perceptions and management decisions of embodied resources (energy and water) on wine grapes, which are the basis of a tourist industry targeting and promoting a leisure lifestyle of conspicuous consumption, rather than on crops that feed more significant segments of the population. This decision may be influenced or reinforced by state and federal policies concerned with more significant economic impacts stemming from the tourism industry and alcohol taxes.

To carry out this study, I propose using political ecology, which includes non-human agency, to follow the flow of wine beginning with the grapes in the vineyard. This approach will allow me to observe how Temecula Valley's people perceive and manage resources as they expand their wine and wine tourism industry during a severe drought.

Chapter Three

Methods

This ethnographic research explores the interrelationships of people, food, energy, and water associated with Temecula Valley's wine and wine tourism industry to reveal contradictions and biases in how people view these resources and how people's perceptions ultimately shape production, environmental management, and policies. This chapter covers the study's research methodology, including (a) an introduction to the research site, (b) description of the research sample, (c) research design, (d) methods of data collection, and (e) data analysis and synthesis. The chapter will also include (f) ethical considerations and (g) limitations of the study before summarizing the chapter.

My main research question is, how are people's perceptions of water and energy embedded, and how do they manifest in the production of food, specifically wine grapes and wine, under the conditions of tourist-oriented agriculture? This general question requires subsidiary questions:

- What strategies are winemakers and vineyard managers employing when making environmental and economic decisions to save water and energy in the context of a historic drought in the region?
- What are the conflicts between actors pertaining to different structural positions associated with the industry (e.g., winery owners, winemakers, vineyard

managers, agricultural laborers, water district officials) regarding water and energy use in wine and wine tourism production?

- What are the challenges of collecting and implementing qualitative and quantitative data on the wine tourism industry to use in Nexus Metrics, like Social Systems Dynamics and Life Cycle Assessments?

This ethnographic study requires an approach that considers the interaction and mutual influence of each sector of the nexus; therefore, a modified hydrosocial cycle approach was used in this research. The modified hydrosocial cycle follows the flow of water from the source through its use and disposal in wine and wine tourism production to attain relevant ethnographic inquiry on the interconnection of food, water, and its embodied energy. The hydrosocial cycle as a method is increasingly used in political economy and ecology to document people's reactions and relationships with resources, as I discussed in Chapter 2.

Following the flow of water and its embodied energy with respect to wine and wine tourism production in Temecula Valley will uncover uneven distribution and use of resources. However, there were problems with following the flow of water. Instead, this research followed the flow of wine or the Vinisocial Cycle. The cycle begins with grapes grown in the vineyard. The grapes are then harvested and made into wine before being used in events in the tourism complex of Temecula Valley. Tourists go to Temecula Valley for the scenic views that are ideal for special occasions, especially weddings. The Vinisocial Cycle improved logistics on who to interview during the season and how actors involved in the cycle contribute to notions of the local terroir.

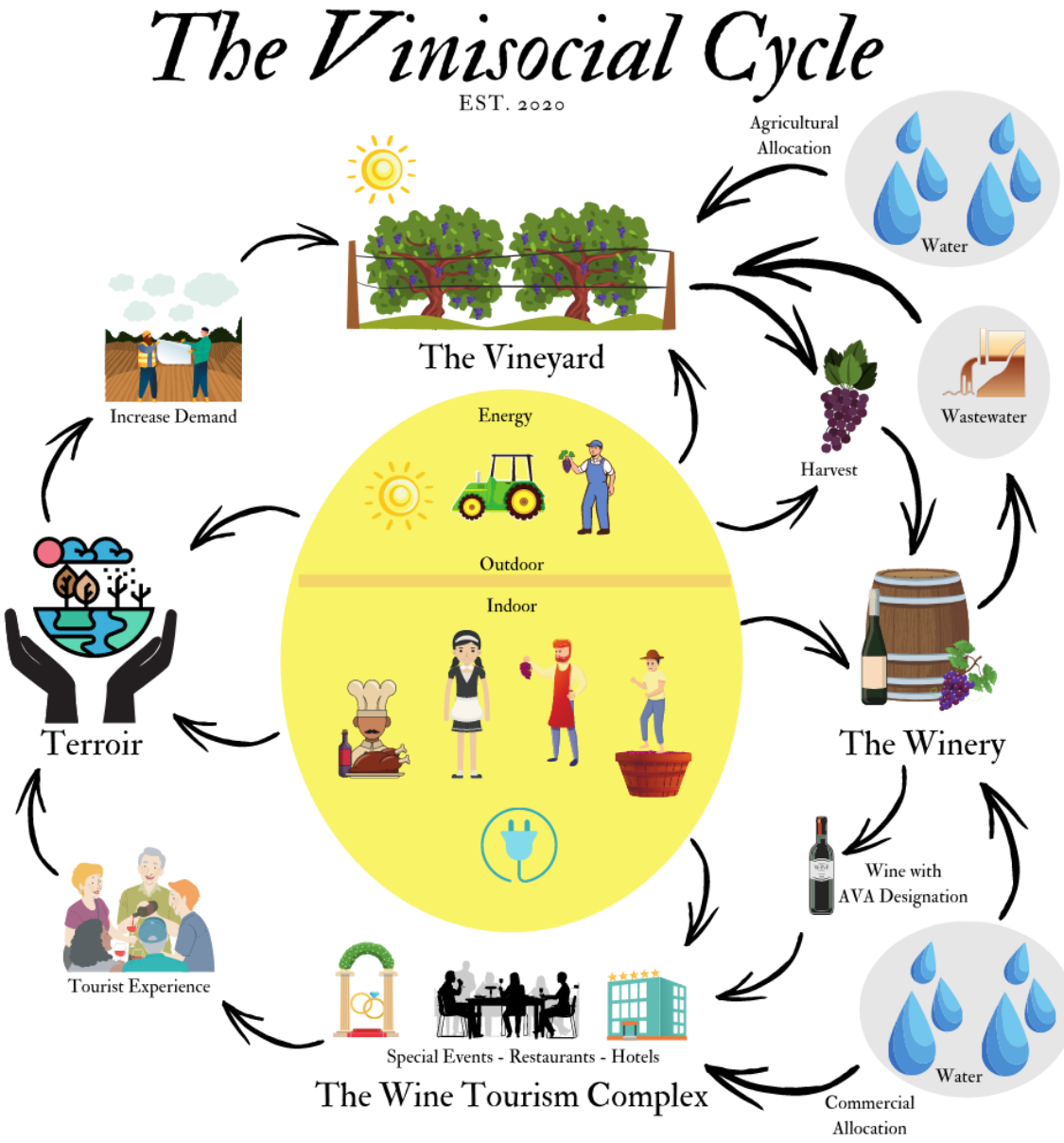

Figure 5. The Vinisocial Cycle. Following the flow of wine beginning with grapes in the vineyard to demonstrate the intersection of resources and how they contribute to the expansion of the wine tourism industry. Image created by author.

This research will also demonstrate how differences in use and accessibility shape perceptions, discourse, and resources management. These relationships help explain the implementation and support of some policies and technologies over others and reveal the

hegemonic structures that may prevent equal access or allocation of food, energy, and water in the Temecula Valley and beyond. The “applied” goal of this research is to provide information on the social aspects of the wine industry of Temecula Valley to incorporate into environmental assessments of the FEW nexus in this valley and other culturally-relevant wine regions. This research will also provide recommendations to the people of the Temecula Valley wine industry and local policy-makers on how they can create a more environmentally sustainable industry.

Temecula Valley and the California Wine Industry

Wine continues to have significant economic and social importance throughout most of the world. Despite the presence of wild grapevines in the Americas, the first production of wine for personal and religious use by the French and Spanish settlers in St. Augustine occurred in 1562 (Robinson and Murphy 2013). The settlers may have used fox grapes (*Vitis labrusca*, like the Concord grape), or Muscadine grapes (*Vitis rotundifolia*), which do not make the best wine (Lukacs 2000, 16-18; Pinney 2007, 11). Two hundred years later, the first *Vitis vinifera*, introduced from Spain by way of the Missions in South America, were possibly grown first in California at Mission San Juan Capistrano around 1779 (Pinney 2007, 238; Lukacs 2000, 60). As they came to be known, the wine made from these Mission grapes was primarily used for mass services and possibly to a lesser extent as a commodity traded within Spanish territory. Of the 21 missions in California, Mission San Gabriel, located a few miles east of Los Angeles, developed into a large and prosperous mission known for its wines. However, foreign commerce was forbidden until the end of Spanish rule. Then, the beginning of Mexican

rule in 1821 until 1833 defined the trade of mission wine, starting with the secularization of the mission properties (Pinney 2007, 241). The secularization of mission properties made land available for “foreigners” to purchase and slowly develop the beginning of the California wine industry as it is known today.

The first commercial winery in California began near Los Angeles in the 1830s by Jean Louis Vignes, who imported European varieties from France (Lukacs 2000; Pinney 2007). Demand for California wines increased with the gold rush, with Los Angeles as a major producer in the mid-nineteenth century. Vignes made the first recorded shipment of Los Angeles wines to Santa Barbara, Monterey, and San Francisco (Pinney 2007). San Bernardino County also provided ideal land for commercial wineries, so that by the twentieth century, there were commercial wineries in Los Angeles, Fontana, and elsewhere in Southern California. Cucamonga, where vineyards date to 1839, had more than twice the vineyard acreage than Napa and Sonoma counties combined by 1920, and by 1940 had 60 wineries. Only 1,000 acres now remain due to suburban sprawl (G.M. Walker and Peragine 2017, 63), opening up opportunities for other regions to meet wine consumption demands, such as the Temecula Valley in Riverside County. All this success in the wine industry occurred in Southern California long before Napa Valley became the primary influence for wines in the United States.

Mission wines were not widely known in the Eastern part of the United States because it was not an American-made product. The state that is recognized now as California and leads the wine industry in the United States was first Spanish and then Mexican territory. Also, transporting wine past California’s geographic and political borders was difficult and expensive. Nicholas Longworth is credited with the first

successful commercial wine production from American grown grapes, thanks to the national borders of the mid-1800s, which did not include California. He began wine production in Cincinnati, Ohio, ironically, with the native hybrid Catawba grape (*V. labrusca x V. vinifera*) discovered by the “Father of American Viticulture,” John Adlum (Lukacs 2000; Pinney 2007,139-149). Soon wine became popular because of its variety of styles when compared to the hard liquors commonly drank in the United States. The lower alcohol levels also allowed for an age of temperance during a time when Americans were notorious hard drinkers.

During the United States' infancy, the renowned Francophile Thomas Jefferson aimed to make wine a democratic drink to be enjoyed by all just as long as Americans could grow grapes to produce their own wines. Longworth made Jefferson’s goal feasible with the Catawba varietal, a much hardier varietal that produced palatable wine. Unfortunately, the vineyard was lost to disease within a couple of decades, partly due to the “wetter” Ohio environment. This failure ultimately benefited California (Lukacs 2000).

In the 1880s, wine became a big business in California due to its drier Mediterranean-like climate, which is ideal for many wine grape varietals. California wine production jumped from four million gallons per year in the mid-1870s to 23 million gallons per year in 1900 (Lukacs 2000). Meanwhile, in the Eastern United States, table and juice grapes became an important cash crop. Production of jams and grape juice, spearheaded by Charles Welch, became more profitable than wine. Wine sales in the Eastern United States began to shift as transcontinental rail lines made shipping California wines “extremely profitable” (Lukacs 2000, 46). By 1910, California produced 45 million gallons of wine and continued to grow. In 2017, California produced over 700 million gallons

(Wine Institute 2019). However, wine did not become a democratic drink to be found on all Americans' supper table, especially farmers, as both Jefferson and Longworth had hoped. Instead, California wines became a mass-produced, urbanized product starting in 1894 thanks to the control of the California Wine Association (CWA). “Because producers and consumers alike increasingly viewed wine as a manufactured commodity, its essential identity as an agricultural product began to be ignored” (Lukacs 2000, 48).

As part of that manufactured commodity that can provide federal tax revenue, the American Viticultural Area, or appellations, were created. Temecula Valley is an AVA, a federally-designated wine grape-growing region with set boundaries approved by the Alcohol and Tobacco Tax and Trade Bureau of the Department of the Treasury. This designation allows wine consumers to know where their wine comes from, or the terroir that they are enjoying from each bottle. To have Temecula Valley on the wine bottle label, 85% of the wine grapes used must grow in Temecula Valley. Wines can have an Appellation of Origin that reflects a political boundary, like a county. Wine with the Riverside County label has to comprise of 75% wine grapes grown in Riverside County. To be a California wine, 100% percent of the grapes must grow in California. All wines must also be finished in the state of origin.

World retail wine sales were $180 billion by 2009 and doubled by 2019 to $370 billion, with the United States accounting for $50 billion of sales (Statista 2019). California continues to be the largest producer of domestic wines (81%) in the United States, while the United States ranks 3rd in the world, following Italy and France (Wine Institute 2019). Annual wine consumption in the United States has risen from 1.31 gallons consumed per resident in 1970 to 3.6 gallons per capita for the drinking age population as of 2010

(International Trade Administration 2011). According to the Wine Institute (2019), the total amount of wine consumed by all ages is 2.95 gallons per capita in 2018, when adjusted with Census data.

The California wine industry accounts for $57.6 billion of the state's economy and has an economic impact of $114 billion on the national economy. There are 3,900 bonded wineries catering to 23.6 million tourists who visited California wine regions in 2018 and spent $7.2 billion in the state (Wine Institute 2019). Most of the California wine industry is centered on large wine grape growing regions, like Napa and Sonoma in northern California or Paso Robles and Lodi in Central California. However, other areas in the state developed competitive boutique wine regions to capture additional revenue from tourism.

Temecula Valley is one of those wine regions and home to a flourishing wine tourism complex consisting of over 40 wineries, which has tripled in size in the past 20 years. Temecula Valley services over 23 million people within a 90-minute drive to the valley. It is located in the southwest portion of Riverside County, approximately 100 kilometers (62 miles) north of San Diego and 150 kilometers (93 miles) southeast of Los Angeles. It is also close to the popular Southern California tourism locations of Catalina, Palm Springs, Coachella, and Big Bear. This relatively new wine region was established in 1968 and had ambitions to become "the next Napa Valley," although its "terroir" is vastly different.

I was introduced to Temecula Valley 25 years ago when I lived in nearby Orange County, California. A friend recently moved to Murrieta, which is a town just north of Temecula. When I visited the wine country, there were only a dozen wineries with small tasting rooms offering free wine tastings. There were two wineries that I remember

visiting: Callaway and Temecula Crest. Famous American entrepreneur Ely Callaway started Callaway Vineyard and Winery. By the time I visited the winery, it was owned by another company, but his legacy lived on. Thanks to Callaway, visitors left convinced that Temecula could only grow white wine grapes. Callaway used this marketing ploy to manipulate demands on wine varietals. Callaway Vineyard and Winery is still around today and has expanded its establishment over the decades.

In contrast, there was Temecula Crest, which was sold in 2000 and became Falkner Winery. The ambiance of this low-key winery was a sharp contrast to the high marketing hype of Callaway. There were few people at the tasting room, which allowed tasters to ask more questions with little sales pressure. Temecula Valley has always provided a relaxed wine tasting and learning experience. These two kinds of wineries became models for subsequent development.

Over the years, this wine region has slowly grown, but it wanted to acquire the same level of popularity as Napa Valley. Therefore, Temecula Valley created the Wine Country Community Plan on March 11, 2014. The Plan encouraged the establishment of up to 120 wineries and their associated vineyards and production facilities by the year 2020 (Yelvington, Dillon-Sumner, and Simms 2014; Yelvington, Simms, and Murray 2012). The area saw some new wineries coming into existence since the advent of the Plan, but Temecula Valley only boasts of less than 50 wineries as of September 2020. In addition, some wineries began expanding their wine tourism by building hotel accommodations and restaurants, while still keeping 75% of the land under production to meet county regulations. In response, some residents expressed concerns about whether water and land resources would continue to be available for such an expansion, and if it

leaves room for other long-held land uses, such as equestrian sports and citrus production. The mix of agricultural land with tourism expansions may blur the division between town (residents) and country (agriculture), making the regulation of resources more difficult. Understanding this division and how resources are viewed, managed, and negotiated will be relevant to this FEW nexus research.

Part of the difficulty in regulating resources, especially water and wastewater, is the lack of self-monitoring devices in the wine industry. Simms (2013) conducted his research on the political economy of water in wine production in the Temecula Valley. He focused on one winery in particular, which did not have the means to calculate the amount of water used during certain events, such as wine production during harvest when most water is used for winemaking. Most wineries have at least two water meters for their establishment, one to monitor agricultural water use and the other for non-agricultural/commercial use, like restaurants and tasting rooms. The water source used for winemaking is typically considered non-agricultural/commercial use. Simms had to install monitoring equipment to quantify water use in wine production to compare against perceptions of water management since the winery did not have the means to quantify specific water use during production.

Simms determined that vineyards and wine production use less water than other crops grown in California or residential housing. Residential zones require 1.6 acre-feet per year when compared to the 1.5 acre-feet per year by wineries. He also observed significant water and nutrient loss from wastewater by the wine industry. His research concluded at the beginning of the California drought, thereby providing a benchmark of the attitudes that one of the then 30 wineries in the Temecula Valley had towards water

management. Simms's research results can be compared against reactions to recent water restrictions due to the drought.

Stricter water restrictions were placed on the people of California on April 1, 2015, when Governor Brown signed an Executive Order (B-29-15) to save water and reduce water waste statewide (Executive Department State of California 2015). Of the 30 items listed in the Executive Order, cities and towns were required to save water by (1) reducing potable urban water usage by 25% of 2013 benchmarks by February 28, 2016, (2) replacing 50 million square feet of land, and ornamental turf with drought-tolerant landscape, (3) implementing rebate programs to replace inefficient household devices, (4) imposing restrictions for 25% water reduction on commercial, industrial, and institutional properties, such as campuses, golf courses, and cemeteries, (5) prohibiting irrigation with potable water of turf located on public street medians, (6) prohibiting newly constructed homes and buildings from irrigating with potable water not delivered by drip or micro-spray irrigation systems, and finally (7) for urban water suppliers to work with the Water Board to develop rate structures and pricing mechanisms as a means to "maximize" water conservation.

The Executive Order also included measures to increase enforcement against water waste, invest in new technologies by implementing Water-Energy-Technology (WET) programs, and streamline government response. WET programs are used to educate the public of the water-energy nexus and how technology can improve our water and carbon footprints. California provides grants to invest in these sustainable changes, including water-saving devices, like showerheads and micro-spray irrigation (see Progams - California Department of Water Resources 2019).

Only two items of the 30 listed on the Executive Order direct the agricultural water suppliers to develop Agricultural Water Management Plans that include detailed drought management plans and provide data on how much water was supplied and used in 2013, 2014, and 2015. Governor Brown has also requested the Department to consider voluntary crop idling water transfer and water exchange proposals. In other words, farmers may opt to temporarily fallow lands, or shift crops, to make water available elsewhere. Nothing more is required of the agriculture sector. The perceived imbalance of water-saving measures is creating tensions between the agricultural and urban sectors.

David Siders and Jeremy White (2015) of the *Sacramento Bee* discuss this disparity to some extent and provide the farmer's point of view. California farmland may use up to 80% of water for irrigation, yet farmers contend that they have been forced to cut back just as much if not more than the urban sector. Water allocations to farmlands have been reduced in amounts ranging from 50% to 100% since the Governor declared a drought state of emergency in January 2014. Some farmers responded to the cutback by removing cash crops that require more significant amounts of water, such as almonds and asparagus, which also take years to mature into production. Farmers that do not have water to grow their crops, in turn, cannot pay the labor that helps manage and harvest the crops. Other farmers responded by taking advantage of their water rights and drilling deeper wells, which caused the depletion of aquifers and land to sink.

The Executive Order Item #10 does require the Water Board to report water diversion and use by water right holders. It gives the Water Board the authority to make inspections if there is a possible violation. Water diversion may refer to surface water (horizontal movement) rather than deeper wells (vertical diversion). What was not

discussed in Siders and White's article was the economic pay-offs that farmers may receive by allowing farms to lie fallow, primarily selling back their water. Also, removing crops before a full growth season will cause smaller harvest yields that may demand higher food prices. Farmers may profit, while farm labor and consumers pay the cost of the drought.

In contrast, the urban sector's response to the tight water restrictions has led California residents to use the news and social media to water shame people of all economic standings (follow #droughtshaming on Twitter, YouTube, and Instagram). Celebrity drought shaming was the most popular, even though the images used in the drought shaming may be of some unknown person's home, or photos are taken before a celebrity implemented drought and water-saving technologies (A. Walker 2015). Rose Hackman (2015) of The Guardian described it as an opportunity for class warfare. Wealthier water wasters can afford $500 a day fines to keep the value and status provided by their home, while poor neighborhoods who cannot afford to use much water, to begin with, have to struggle to reduce use by 25%.

Drought shaming has since extended across the United States. Almonds, which use about a gallon of water per nut, were California's No. 2 agricultural crop in 2015, recently moving ahead of grapes. The drought "has made almond growers into symbols of agricultural power and waste" (Fox 2015). A *Mother Jones* blog post titled "Your Almond Habit is Sucking California Dry" suggests that the increasing global demand of almonds causes farmers to plant more trees and dig deeper, aquifer-depleting wells (Philpott 2014). The post goes as far as to suggest that the depletion of groundwater could trigger

earthquakes. These discussions have caused people to question their almond consumption (Hamblin 2014; follow #almondshaming on Twitter).

In the *Mother Jones* blog post, grapes come in at a mere 0.3 gallons of water per grape (see Figure 2). Vineyards may use less water than other crops, and wine production may use less water than single-family residences (Simms 2013), but this does not consider the consumption of water and the production of wastewater associated with on-site wine tourism. In contrast to the almond shaming discourse, wine shaming is used tongue in cheek to refer to drinking too much, leaving wine in a glass without finishing it, or misusing wine terms. Some winery and vineyard owners have used the drought as an opportunity to demonstrate on media outlets their efforts to cut on water use, and possibly cost, to keep their profit margin. However, the real danger to the wine industry comes from unflushed salts in drought-stricken soils since grapevines are drought tolerant (Balakrishnan 2015). Former Mondavi winemaker Thibaut Scholasch states that vineyard managers have to be retrained on their water use. He observed how people are growing vines like landscape, and suggests cutting water by 40% and to stop depending on what they see, referring to wilting leaves on vines. This type of deficit irrigation would allow grapevines to grow deeper roots and make them more drought-tolerant.

The California drought may reveal how prepared or unprepared people, businesses, and institutions are to deal with this severe drought. The wording in the Executive Order suggests a lack of data and transparency of water consumption metrics by agriculture, which may indicate what is known as an infrastructure management gap (Schweitzer and Mihelcic 2012). In Temecula specifically, the sewage system is being expanded to accommodate wine tourism and residential development plans (Yelvington,

Dillon-Sumner, and Simms 2014; Yelvington, Simms, and Murray 2012; Simms 2013), but they will not upgrade their system to reclaim wastewater for irrigation. To make informed decisions about wastewater management, engineers suggest that decision-makers should evaluate resource recovery against appropriate technologies. This assessment will fill the infrastructure management gap and link sanitation goals with water management and food production goals (Verbyla, Oakley, and Mihelcic 2013), such as the water consumption reduction mandated by the Executive Order.

In summary, California is synonymous with wine in the United States and throughout the world. The California wine and wine tourism industry had a tremendous economic impact on California and the nation by providing jobs and tax revenue. Temecula Valley is one of those wine regions expanding to accommodate business and tourism development for the area. However, the drought may cause hardship in accessing adequate amounts of water to meet development demands. How much water or how much energy is being used in wine and wine tourism production seems unclear. We do not know what attitudes wine producers have toward engineered solutions to save water and energy while increasing wine grape production. Although environmental scientists and policymakers call for more qualitative data for the FEW nexus, Temecula Valley and the wine industry, in general, need more quantitative data collection as well.

This research begins with the harvest of August 2015 and continues to the following harvest in September 2016 in Temecula Valley. During this period, participants living in the Valley were anticipating a healthy amount of winter rains from El Niño and snowpacks to flush salts from the soil and recharge aquifers and rivers. This weather event allowed me to observe people’s preparations and expectations for relief from the

drought against people's reactions to the drought. Specifically, I can observe the people's response to the Executive Order, including which strategies they adopt to grow its wine tourism industry.

Brief Description of NSF Research Project and Personnel

The research reported in this dissertation was part of a larger team research project titled "The Political Economy of Branding a New Site for a Specialty Industry" funded from 2013-2017 by the National Science Foundation's (NSF) Cultural Anthropology program (award number 1261812) and directed by project Principal Investigator (PI) Kevin A. Yelvington of the Department of Anthropology at the University of South Florida (USF). I was recruited into this research project during the annual meeting at the Society for Applied Anthropology (March 24-28, 2015) after I discovered that my proposal to conduct FEW Nexus research of the tourism industry in the U.S. Virgin Islands (USVI) would not be funded by another grant. In March, 2015, the PI submitted a request for funding with input from my USVI proposal to respond to a Dear Colleague Letter from the NSF, "SEES: Interactions of Food Systems with Water and Energy Systems" of February 2, 2015. This letter announced funds available for currently funded projects to strengthen the food-energy-water (FEW) component of those research projects. Funding was obtained by the PI later in 2015 and it is this funding stream that supported the ethnographic fieldwork that forms the basis of this dissertation from August, 2015 until May, 2016.

Yelvington had started ethnographic fieldwork and archival research in 2010. The study aimed at an historical and ethnographic investigation of wine production,

consumption, and wine tourism in the Temecula Valley, a wine growing region located in southern California. The goals were to investigate the ways in which winery owners, winemakers, marketing specialists, and consumers co-construct a "Temecula Valley *terroir*," a sense of distinction and aesthetic valor – a "taste of place." It seeks to understand the historical political economy of landscape transformation and the development of vineyards and wineries and the uses of natural resources, especially water, in this process; to examine the multiple labor processes upon which the production of wine is built; to understand how wine is commodified and consumed; to account for the state's role in development and regulation; and to investigate how wine consumption occurs in the context of the "branding" of the Temecula Valley as wine tourism destination – as a geographical space that becomes a cultural "place" – as part of a regional tourism complex.

USF Applied Anthropology graduate students, postdoctoral researcher, expert consultants, and graduate and undergraduate students from other universities comprised the research team. A division of labor was established, directed and coordinated by the PI, where team members were assigned particular topics. In practice, team members worked in more than one area. USF Applied Anthropology graduate student Jason L. Simms conducted ethnographic and archival fieldwork during 2012 on an aspect of the environmental concerns of the project – water use in wine grape growing and in wine production – for his Ph.D. dissertation (Simms 2013) and in 2013 conducted participant-observation fieldwork, key informant interviews, and archival research in Temecula and at various places in northern California. USF graduate student Laurel D. Hansell (née Dillon-Sumner) conducted ethnographic research in 2013 on public policy relating to

expanding the Temecula Valley's "wine country" (Dillon-Sumner 2014). In January, 2015, Elizabeth Aparicio (née Murray), a USF Applied Anthropology Ph.D. student, started her year-long fieldwork on aspects of how place is "branded" in the wine tourism industry.

In the summer of 2016, three non-USF postdoctoral research assistants – Anthropology Ph.D.'s Anthony Jerry, Veronica Miranda, and Ryan Anderson – conducted participant-observation ethnography and key informant interviews on the experience of wine tourists in the Temecula Valley with an emphasis on their consumption behavior. As well, they conducted oral history interviews and archival research to provide the project with pertinent data. Jerry recruited three of his former undergraduate students at San Diego State University – Marisa Alvarez, Grecia Pérez, and Liacel Wesson – to assist in surveying over 230 wine tourists in winery tasting rooms. Shelley LaMon, a graduate student in Anthropology at the University of California-Santa Bárbara, worked on the project as a research assistant to conduct ethnographic, oral history, and archival research from the beginning of January through the end of March, 2017. Finally, the PI added Tim Stroshane, an expert on the technical and political aspects of water in California (Stroshane 2016), as a consultant on groundwater availability, water delivery, water financing, the history of water litigation, and other aspects of water as it relates to the sustainability of the California wine tourism industry. The PI conducted research on all aspects of the project, concentrating on vineyard and winery labor, business decisions by winemakers and winery owners, the science of creating wines for the Temecula Valley tourist market, aspects of the tourist experience, and conducting archival research for historical information in numerous repositories throughout California. Publications from

the project include Yelvington, Simms, and Murray (2012) and Yelvington, Dillon-Sumner, and Simms (2014).

Research Sample

Temecula Valley is a federally-designated AVA that is zoned as agricultural with a few residents with large tracts of land present in the valley and was the area I focused on for this research. Some residents grow grapes or keep horses on their acreage that is within the AVA. The only businesses allowed to function within this AVA must support the wine industry in some capacity. Businesses in the AVA can only produce and cater to the consumption of wine grape products, with a few exceptions to aid restaurants. For example, bars that focus on beer and non-grape liquor is not permitted; however, a bar that is part of a winery's hotel or a restaurant associated with a winery is fine. The main concern is that their income comes primarily from wine.

For this study, stakeholders were defined as those people who lived or worked in Temecula Valley's wine industry in one capacity or another. Residents of neighboring Temecula and other towns were not pursued, but discourse between neighboring residents and the wine industry was documented when the opportunity presented itself. Stakeholders were limited primarily to people involved in varying scales of wine and wine tourism production within this agricultural district to focus on relationships with three resources: food, water, and energy. I lived in Temecula from November 2015 to May 2016 for a total of six months to be near the research site. Also, I made shorter ten-day trips outside this period to observe over a year's worth of events. In all, I was in Temecula Valley from April 2015 to September 2016.

Participants were recruited using a combination of purposive and snowball sampling. I used purposive sampling when I identified an individual that could give me information-rich cases, such as winery or vineyard owners who manage or pay the utility bills, or the water district representative that promotes water policies. Bernard (2011) says that purposive sampling is widely used to target people from each population group. I wanted to observe multiple perspectives of how wine, water, and energy are managed in the valley to maximize variation in my purposive sampling. Rather than focus on the person making the decision and giving orders, I followed the flow of resources, specifically wine production, to observe how instructions were carried out and determine any deviations to resource management down the chain of command.

For “hard-to-find” populations, like those in positions of power and authority, I employed a snowball, or referral, to connect with these potential informants. Some members of this wine industry community are hard to access for interviews. After all, who does not want to make friends with a winemaker? Once I had access to some participants in a winery, I would attempt to recruit participants in other positions within that winery. For example, there were cases when the winemaker helped me recruit the winery owner or the vineyard manager. Some participants were reluctant to connect me with higher status people due to concerns of making those individuals vulnerable or place them on the spot when discussing water use, but not because they saw their participation in my research as a problem. I also had the opposite reaction when I removed two participants at one winery after an unpleasant interaction from the winery owner. In this case, participants wanted to continue the study, but I was concerned about retaliation from the winery owner since he had an unpleasant reputation in the valley.

Research participants consisted of winemakers, winery owners, vineyard managers, domestic vineyard owners, and tourism support staff, such as chefs of restaurants and facility managers of wineries with resorts and restaurants. If I was able to interview someone in each of these positions from one winery (except for domestic vineyard owners), then I would consider it a full representative sample of a winery. I also interviewed experts in water management (engineers and water district representatives) for this study. Most individuals were recruited from Temecula Valley AVA, except for a farmer located outside the wine country designation that was affected by Temecula Valley. In total, I have 32 recorded interviews; however, domestic vineyard owner interviews often included a husband and wife. Out of the 32 recorded interviews, there were a total of 37 people participating in this research. With the purposive and snowball sampling strategies, I was able to recruit at least one participant from 11 wineries within the valley (either winery owner, winemaker, or vineyard manager), not counting water district officials, domestic vineyard owners, farmers, or tourism staff. Of the 11 wineries, I was able to interview a full representative sample of two wineries. From the rest, five of these wineries had contracted independent vineyard managers, yet I was able to interview at least two individuals from a unit (winery). Therefore, seven wineries provide full representative samples based on their scale of production. All wineries were given a pseudonym representing lemon and lime varietals.

In order to understand the findings, the participants' roles or designations need to be defined. For this research, the participants were labeled for specific designations and roles in the production of wine and wine tourism as follows:

Table 2. Breakdown of participants and their role in the valley. Names are pseudonyms using Hollywood actors. The wineries have citrus names as pseudonyms. The winery participants may be associated with and the scale of the winery are included. Ind under Scale category means Independent Vineyard Manager.

Participants							
No.	**Pseudonym**	**Role in Wine Industry**	**Winery**	**Scale**	**Gender**	**Age**	**Ethnicity**
1-2	Scarlet Johansson and Chris Evans	Domestic Vineyard		Small	F	30s	Hispanic
					M	40s	Non-Hispanic White
3	Kevin Spacey	Domestic Vineyard		Small	M	60s	Non-Hispanic White
4-5	Richard Burton and Elizabeth Taylor	Domestic Vineyard		Small	M	60s	Non-Hispanic White
					F	60s	Non-Hispanic White
6-7	Ryan Reynolds and Blake Lively	Domestic Vineyard		Small	M	40s	Non-Hispanic White
					F	50s	Non-Hispanic White
8	Joaquin Phoenix	Domestic Vineyard / Water		Small	M	50s	Non-Hispanic White
9	Matthey McConaughey	Domestic Vineyard		Small	M	50s	Non-Hispanic White
10-11	Sandra Bullock and Keanu Reeves	Domestic Vineyard		Small	F	50s	Non-Hispanic White
					M	50s	Non-Hispanic White
12	Edward Norton	Owner / Winemaker	Eureka	Medium	M	50s	Non-Hispanic White
13	Quentin Tarantino	Owner / Winemaker	Kaffir	Medium	M	50s	Non-Hispanic White
14-15	Michael Douglas and Catherine Zeta Jones	Owner / Winemaker	Lisbon	Medium	M	80s	Non-Hispanic White
					F	60s	Non-Hispanic White
16	Meryl Streep	Founder	Meyer	Medium	F	80s	Non-Hispanic White
17	Antonio Banderas	Vineyard Manager	Meyer	Medium	M	50s	Hispanic
18	Javier Bardem	Winemaker	Meyer	Medium	M	30s	Hispanic
19	Chris Pratt	Owner / Winemaker	Persian	Medium	M	40s	Non-Hispanic White
20	Ben Kingsley	Winemaker	Tahiti	Medium	M	50s	Non-Hispanic White
21	Gary Cooper	Owner / Winemaker	Tahiti	Medium	M	80s	Non-Hispanic White
22	Dwayne Johnson	Winemaker	Bearss	Large	M	40s	Black
23	Woody Harrelson	Chef	Bearss	Large	M	40s	Non-Hispanic White
24	George Clooney	Winemaker	Key	Large	M	50s	Non-Hispanic White
25	Robert DeNiro	Owner / Water	Ponderosa	Large	M	50s	Non-Hispanic White
26	Gordon Ramsey	Chef	Ponderosa	Large	M	40s	Non-Hispanic White
27	Daniel Day-Lewis	Facilities	Ponderosa	Large	M	50s	Non-Hispanic White
28	Robert Downey Jr	Vineyard Manager	Ponderosa	Large	M	50s	Non-Hispanic White
29	Patrick Stewart	Winemaker	Ponderosa	Large	M	50s	Non-Hispanic White
30	Al Pacino	Owner / Winemaker	Primofori	Large	M	40s	Non-Hispanic White
31	Tom Cruise	Vineyard Manager	Verna	Large	M	40s	Non-Hispanic White
32	Bradley Cooper	Winemaker	Verna	Large	M	50s	Non-Hispanic White
33	Steven Spielberg	Winery Owner	Verna	Large	M	50s	Non-Hispanic White
34	Jackie Chan	Vineyard Manager		Ind	M	60s	Hispanic
35	Christian Bale	Vineyard Manager		Ind	M	40s	Non-Hispanic White
36	Emma Stone	Water District			F	30s	Non-Hispanic White
37	Chris Hemsworth	Olives			M	40s	Non-Hispanic White

Winery Owner – owns the land to grow grapes and the winery to produce wines. They are the chief executive officer of the winery. Some winery owners, especially in smaller and older establishments, are also winemakers.

Winemaker – a person designated as a winemaker does not typically own a winery, but is hired to make wine and supervises winemaking staff and the vineyard manager. The winemaker works with the vineyard managers to coordinate watering and pruning strategies, when grapes are ready for harvest, and what varietals should be planted to meet wine demand.

Vineyard Manager – manages the vineyards and determines the agricultural and labor needs of the grapevines. If employed by the winery, they work closely with the winemaker to decide best management practices. However, the winemaker typically has final discretion to executed techniques. There are independent vineyard managers that have contracts to care for several vineyards of domestic vineyard owners and typically medium wineries.

Domestic Vineyard Owner – these participants own acreage within the Temecula Valley AVA, which allows them to grow wine grapes for their own winemaking or to sell to local wineries. They play an essential role in supplementing grapes or juice to meet demand. They often hire a Vineyard Manager to care for the vineyards, harvest grapes, and negotiate their fruit's sale to local wineries. Many domestic vineyard owners experiment in making their own wines for home consumption.

Tourism support staff – these individuals support the tourist sector of the wine valley by managing facilities, specifically resorts or restaurants, that support the wine

tourism industry. They are not directly involved in wine production or vineyard management.

The goal was to target at least ten vineyards and wineries representing three different scales based on acreage. Stakeholders input and zoning ordinances supported the descriptions, or criteria for these categories:

Small = less than 10-acre vineyard, no tasting room

Medium = 10-20 acres vineyard, winery, tasting room with a vineyard manager in-house or as an independent contractor

Large = 20+ acre vineyard, winery, tasting room, hotels and/or restaurant

I was able to target 11 wineries out of about 43 wineries. All wineries in the valley fall in one of these scales of production listed above, so I collected a representative sample of at least five wineries for each scale. I also targeted seven domestic vineyards that support the wineries included in this study since the total amount of domestic vineyards in the valley fluctuates from month to month due to moving in or out of the valley or deciding to add a vineyard to an existing residence.

I searched for participants that implement different water and wastewater management strategies (i.e., dry-farmed vineyards, deficit irrigation, standard irrigation) to observe how the size of a vineyard affects wine production demands, resource management, and perception of resources. In addition, the variety of stakeholders and their position in production provides data on how resources are perceived and managed among different members in wine and wine tourism production. During the pilot study, some people in Temecula Valley commented that there was plenty of water because an aquifer was located underneath the valley. This comment prompted me to ask participants

where their water comes from because perceptions of water quantity will influence best management strategies, as well as energy use.

Research Design

To carry out this research, I followed these steps:

Research proposal - the proposal included a literature review on the contributions of anthropologists and other researchers on the broad topic of FEW Nexus. The review helped me identify a gap in knowledge on perceptions and use of multiple resources in food tourism production to connect it with Temecula Valley's wine production and wine tourism development.

Institutional Review Board (IRB) - after defending my research proposal, I received approval from the IRB to pursue my research (Appendix A). The IRB includes the questions I would ask participants and disclose any risks. Participants were given the opportunity to opt-out of the research at any time. In addition, I replaced the name of participants with the name of movie actors to give a Hollywood influence. Wineries were named after citrus, specifically lemons, and limes, for an ironic twist on the research. Pierce's Disease is passed by the glassy sharpshooter, which likes to live in citrus, so the presence of citrus causes some contention among agricultural managers in the area.

Participant Observation - I was introduced to some participants by research team members who were already doing their research in Temecula Valley. Stakeholders were familiar with the larger body of research, and this provided access to the first set of participants. An established presence allowed me to observe how stakeholders

responded to resources, especially laborers that were not formally interviewed for this study.

Public Presentation - I presented my research to the community on Grape Day (April 2016) as one method to recruit interview participants. Grape Day is a local wine industry conference that takes place in Temecula Valley. Speakers from outside of Temecula Valley are invited to present on topics of interest to the winemaking community. The presentation, “Save Water, Drink Wine: Perceptions and Practices of Resource Management in Temecula Valley Wine Country,” occurred towards the end of my time in the field, but generated a tremendous amount of interest. I summarized my research proposal, starting with explaining a Life Cycle Analysis and how I wanted to collect ethnographic data to help enrich these types of analyses. I also mentioned how land, energy, and water are interconnected in the hope that people recruited after the presentation would talk more about their energy use and future land development. The presentation also helped ease people’s concerns about whether I was some form of “water police.” In the end, I was able to collect more data on wine production, water use, and land development, but there was still a disconnect with energy.

Semi-structured interviews - most interviews were conducted after presenting my proposal to the community. The interview consisted of 18 questions (see Appendix A) ranging from thoughts about wine as food to where their water came and how tourism development would affect access to resources. The interview questions included topics on participant’s perceptions and practices regarding food, energy, and water and their thoughts on future tourism development in the valley (Appendix A). The stakeholders provided their perspective on the social, economic, and ecological impacts of wine

production and tourism in the Temecula Valley. Demographic data were collected at the end of the interview, and interviews were recorded and transcribed. Interview responses were analyzed within and between groups of stakeholders.

Archival data - data was collected from newspaper collections in the library or from personal collections provided by stakeholders. In addition, quantitative data was gleaned from the literature review of the life cycle analysis of wine and wine tourism production. Finally, there were sources of archival material only available online.

Data-Collection Methods

To answer the research questions, I employed a variety of qualitative methods to create a rich ethnography of the wine industry's perspective of the FEW Nexus. I used archival data, participant observation, and semi-structured interviews in this research. A mixed-methods approach would have provided complementary qualitative and quantitative data, and typically each method is used to triangulate data (Schensul and LeCompte 2013). Denzin states that "the rationale for this strategy is that the flaws of one method are often the strengths of another and by combining methods, observers can achieve the best of each while overcoming their unique deficiencies" (1978, 302). In other words, the product of triangulating data is the convergence of results. Any inconsistencies suggest that the strategy has to be reassessed for bias in the method, informants, or investigators that prevent the convergence of the results (Mathison 1988). However, Mathison (1988) argues that focusing on convergence can lead to "phantom images" rather than a holistic understanding of the situation. She suggests that inconsistencies and contradictions, along with convergence, provide valuable information to the

researcher, primarily allowing the researcher to explore why there is not convergence. For this research, I was able to document inconsistencies with how people responded when compared to how they behaved. These inconsistencies revealed cultural differences in relationships with resources among an economically diverse community.

The primary methods for data collection were participant observation and interviews because they have the potential of offering a detailed description. I used archival data collection to add or explain what was being said and observed.

Archival Research

Archival research has been ongoing for this project since 2010, and especially after the main project into Wine Tourism was funded by the National Science Foundation (NSF) from 2013 until 2017. The archival data collected over the years and by various people on the project includes books, newspapers, advertisements, photographs, and videos. Digital copies were stored in a secure network drive at the University of South Florida, and hard copies were kept in the Department of Anthropology. In addition to traditional archival material, I also include online and social media sources, which can include social media posts, online newspapers, blogs, and vlogs.

I consider these sources elusive because one can have access to an online source one moment and not the next because it was deleted or altered. Yet, posts can provide immediate commentary on the events taking place at the moment and mark the start of trends. For example, before going out to the field, there was a hashtag campaign presumably in California where posts were shaming celebrities as well as neighbors over their water usage (#droughtshaming). It is difficult to pinpoint the geographic location of

the person posting or their connection to that location since people often choose to use a pseudonym. I used this type of data to get a general sense of how people viewed resources and how their posts could influence stakeholders in the same way a newspaper article can. We do not know who reads the newspaper or magazine, unless they reference it, just as we cannot be sure who is reading a social media post on any given subject. Yet, this form of media has a great, if not more significant, influence in today's society than newspapers, which is why a successful vlogger is referred to as social influencer.

I only collected social media posts and news articles from public sources using the keywords: California drought, Temecula wines, Southern California water, Southern California energy, wine as food. Social media posts were collected from March 2015 to November 2016. News articles relevant to this research were collected from March 2015 until September 2020. However, some older links to electronic articles have moved behind paywalls where one needs a subscription to read the contents. I saved digital copies of websites whenever possible, but some websites are not designed to be printed to paper, so the information and graphics becomes fragmented. Another challenge with using websites is that the owners can update the content.

Participant Observation / Observant Participation

The most considerable portion of my data collection involved getting close to people, so they were comfortable to share information with me, also known as participant observation. Mainly, I went to the wineries and rotated between wineries depending on what tasks were coming up in the wineries and vineyards. The wineries typically close by 5 pm every evening except on the weekends, where some wineries stay open until 9 pm.

Classes or meetings were often in the evenings after the wineries closed. Participant observation of the vineyards could take place at any hours of the day. I have spent the evenings helping with the harvest, or the mornings (4 a.m.) helping with pruning, depending on the tasks required throughout the season. The one task I was not able to attend was starting or stopping of irrigation to the vineyards because participants did not allow me to witness irrigation practices.

My re-introduction to Temecula Valley wine country occurred in April 2015 when I attended my first Grape Day as part of my preliminary research. I was accompanied by Kevin Yelvington, the NSF grant principal investigator, and introduced to at least three vineyard managers and winemakers with whom I later worked as part of my participant-observation ethnographic fieldwork. I was never hired or paid for my labor by any winery, except for the occasional bottle of wine everyone receives after bottling. By unofficially working in the wine industry, I gained access to the “behind the scenes” work that is not typically accessible to wine tourists. This access allowed me to document the discourse over wine and resource management. I visited Temecula off and on from April 2015 to December 2015, witnessing larger events in the wine industry, like Grape Day (April) and harvest (August and September), as well as the vineyard’s dormant period soon after harvest.

When the vines are dormant, people can shift their focus on winemaking rather than grape harvesting before starting the cycle again at the beginning of the year. During the dormant period is when I started to live full-time in Temecula from January 2016 until May 2016. Although my whole research period was not spent continuously in Temecula, I was able to witness a year’s worth of life in the wineries and vineyards. It was an ideal

time to do fieldwork on perceptions of FEW Nexus. As luck would have it, the drought became worse, and agricultural water usage was further restricted by the recent Executive Order B-29-15 (Executive Department State of California 2015). Also, people throughout California were counting on the weather formation known as El Niño. I was expecting to witness the drought and then an abundance of rain within my year's span of research.

Most of my participant observation occurred in the wineries, either helping with wine production or partaking in tourist activities to see how resources were managed and discussed to visitors. I spent days observing or helping with cleaning tanks, barrels, and other winemaking equipment to see what techniques one winery was using over another. I spent a couple of back-breaking days bottling wine with students studying viniculture (winemaking). I also had the opportunity to help the winemaker during different phases of the winemaking process. I would have lunch in wine country at the wineries that had restaurants to see how they managed water and take the opportunity to recruit another winemaker or chef to my study. When I was not in the wine country, I was at libraries collecting archival material not available online, helping the Temecula Valley Winegrowers Association, or attending water district meetings or wine industry classes.

Interviews

The second-largest component of my data collection was conducting semi-structured interviews. At the beginning of my research, I had some trouble collecting interviews. My breakthrough was after I presented my research at Grape Day in April 2016 to explain my research and why I was always hanging around wineries. After I

presented my research, stakeholders were more encouraged to participate. I scheduled most of my interviews in the remaining weeks I had to leave the field in the month of May. Interviews were conducted at the location of their choosing, so they had the privacy they felt they needed, which often occurred in homes, in vehicles, or private areas of a winery or vineyard. I conducted semi-structured interviews based on questions submitted for IRB approval. Before the interview commenced, the interviewee was asked to review the consent form. I received verbal consent, and no signatures were collected for further protection. A copy of the study and my contact information was left with participants, in case they had questions or concerns. Interviews were digitally recorded and saved on a secured network drive. Interviews lasted from 15 to 90 minutes ending with demographics questions.

Data Analysis and Synthesis

The amount of data collected posed a challenge. Interview information was organized in a spreadsheet during my time in the field to assist in determining whether I covered all roles in a winery or if I had enough variation in winery sizes targeted for this study. Names of participants and wineries were coded to protect informants. Once the research season was over, the data were analyzed using a grounded theory approach. Interviews were transcribed and then coded using an “open” coding technique since there are few if no multiple resource ethnographies to guide this research. Emerging themes from the open coding were linked with my observations of patterns in the text. Codes created were water use: water regulations, water perception, water saving strategy, nutritional value of wine, social value of wine, economic value of wine, wine as food,

energy saving strategy, perception of energy. To assist in organizing the data analysis portion of this study, I used the software MAXQDA 2018 to code the transcriptions listed above.

Ethical Considerations

My research followed the ethical guidelines of the American Anthropological Association and the rules and regulations of the University of South Florida IRB. To avoid "doing harm," I provided transparency of my research and communicated to stakeholders the option to opt-out or limit the data I can present in my research. I had two ethical concerns that may have affected the results of my study.

My first and primary concern was the consumption of alcohol during interviews. Due to the social nature of wine and the industry I was studying, wine was often shared during interviews, and to refuse felt rude. Alcohol consumption reduces the inhibitions and allows for participants to be more forthcoming, which helped provide a relaxed interaction. I was prepared to stop any interview if there were signs of intoxication or highly reduced inhibition. Also, I informed the participant that he or she may contact me if they do not feel comfortable with anything they shared during the interview. I never felt that a participant or I was intoxicated during an interview to the point of crossing any ethical boundaries. If there were comments made during participant-observation, which made me question how inebriated the person was, they were made in public, like a tasting an event. However, the comments did not provide sensitive information that could cause participant harm, but rather offered information on their character and personal beliefs.

The second concern was mapping the valley. In my research proposal, I considered using a Geographical Information System (GIS) to organize data based on geographic location. This technique would allow me to document the size of wineries, proximity to resources, and connect my qualitative data to nexus metrics with a place, essentially mapping Temecula Valley's terroir. However, it soon became clear to me that this technique would place my participants at risk and could hinder data collection since the water district was closely monitoring water use. As an archaeologist, I have had experiences with sharing maps of cultural resources in outreach efforts that were meant to assist the cultural managers. Despite my disclaimer to these individuals, GIS products were used for policymaking or policy enforcement, which was the intention. In Temecula, Rancho California Water District uses GIS to calculate water use for each home under their jurisdiction. However, how much water everyone uses is not openly shared with the public. My concern was that transparency of water use among wineries and vineyards could lead to tensions in the community, or that ethnographic information could influence the water district to target businesses or individual's water use based on other parameters. Since using this data collection technique could have detrimental effects on stakeholders, it was quickly removed as a data collection method early in the study. However, these challenges were mentioned to demonstrate how accessing data or attitudes towards data collection is an ongoing theme in this study.

Limitations of the Study

The study had certain limitations typically found in ethnographies. I gave careful consideration on how to navigate around given limitations to minimize impact on the

study. There were three limitations that can be categorized down to one concern for varying reasons: adequate access.

The first limitation was access to resources or resource use. I proposed collecting ethnographic data by following the flow of water as part of a modified hydrosocial cycle approach. My initial intention was to literally follow the flow of water, per Anand's (2015) example, to observe people's relationship with water, how this resource intersects with other resources, and how management decisions are made. However, I sensed hesitation from participants. After all, the people that would show me the flow of water were even further down the chain of command. For example, coming across a recently-broken pipe caused a laborer to worry that I would report them to someone, although it was not clear to whom. After this incident, I started to notice how vineyard managers and laborers would not show me their main water lines. Also, collecting information from water officials on water line locations was impossible due to security measures implemented to protect people from terrorist attacks by way of our water resources (Copeland 2010). Therefore, to overcome these obstacles, I followed the flow of wine rather than water. After all, the primary purpose of the hydrosocial cycle approach is to follow a cycle of a resource to see how people and, in this case, other resources interact and respond with one another. Therefore, the obvious solution is following the winemaking cycle starting when the vines go dormant after harvest to the next harvest, roughly October 2015 to Sept 2016.

Energy was even harder to follow. The two primary sources of power used at a winery are electricity and propane or natural gas. I observed how people were using water and its associated energy. Yet, when I asked about energy in a vineyard, participants would describe the plant's energy use in the form of photosynthesis and fruit production.

This example is not exactly what an engineer needs for FEW nexus solutions, but provides insight on the relationship wine actors have with energy, wine grapes, and wine production to explain the kinds of decisions they are going to make with their resource management. This response also reinforces my decision to follow the wine rather than the water.

Another limitation of my study is access to hard numbers, like the amount and cost of water and electricity used, and the amount of wine production, which are typically used for water and carbon footprint analyses or LCAs. This limitation came about for several reasons. One set of numbers I was interested in collecting was the actual water and energy use by wineries or vineyards. While domestic vineyard owners were willing to share this data, larger facilities were not. After all, I was collecting data at the peak of the drought, and there were previous rumors that water use could be further cut. Winemakers were willing to share the data, but they did not have access to the information, and what information they did have access to, they hesitated to share for fear of the owner's reaction. I offered to speak to the owners directly, and in some cases, this seemed like it could also cause trouble for the worker. Therefore, I did not pursue quantitative data from my participants.

There was one set of data that I could not include in this study, which was unfortunate. I was able to interview participants from a winery that was engineered to function more sustainably to some degree. I was interested in understanding the owner's worldview and approach to wine production and wine tourism since he had an engineering background. However, the owner's response was somewhat hostile, especially when he learned it was anthropological research. Although he did not directly object to the

participation of the employees of his winery, he highly objected to the use of anthropology for this type of research. It was not “hard science,” as far as he was concerned. I was not sure if he was offended or was more concerned that I would share his secrets with other winery or vineyard owners. I did feel from other wineries that there was a sense of concern for what I would call “winery espionage.” This possible concern is somewhat ironic if one believes in terroir (soil and climate) for wine quality. In any case, it was difficult to get any follow-up interviews from this particular winery, so they were excluded from the study to prevent any harm. However, this reaction or concern of winery espionage may have also contributed to limited access to people in other wineries and vineyards that were contacted but were not interested in participating.

It also caused a little tension during vineyard tasks when my labor was exploited in the vineyard with little exchange of information because the workers spoke only in Mixtec. Later, I was tasked with my work, which was too far from the men to make observations. My follow up questions with the Spanish speaking managers from the group of Oaxacan men were only met with evasive answers. The vineyards are almost exclusively worked by men from Mexico or Central America who bring along their feelings of women working in the vineyards (for good or bad). This response caused an unexpected limitation to my time in the vineyard compared to other parts of the winery. Since my focus was not on labor specifically, but how laborers viewed and worked with resources, I concentrated efforts on specific vineyard events with people that were willing to talk to me.

Chapter Summary

In this chapter, I explained the methods used in this research to answer my main research question - how are people's perceptions of water and energy embedded, and how do they manifest in the production of food, specifically wine grapes and wine, under the conditions of tourist-oriented agriculture? Using purposive and snowball sampling, this study collected data from 37 stakeholders involved in five different roles of the wine and wine tourism industry. The information from 16 units (wineries or domestic vineyard owners) that fall in one of three scales of production (small, medium, and large) were collected, transcribed, and analyzed within the limitations and ethical considerations of this study. In the following chapters, the ethnography will be organized using the flow of the Vinisocial Cycle I presented in Chapter 3. The ethnography begins with the interrelationships observed in the vineyard, then flowing into the winery, and finally, the wine tourism complex and attitudes about food.

Chapter Four

The Vineyard

> We moved from a 16th of an acre tract house [in Fontana] with a small amount of grass to five-acres and have a lower water bill. I was concerned… with this size property how much water it would be, but it's been surprisingly really good. (Scarlet and Chris, Domestic Vineyard owners)

This young family moved to Temecula for the opportunity to have a bigger home for their growing family and access to excellent schools. Although the wife's family has some farming background, owning a vineyard was a new experience for the couple. Like many Domestic Vineyard owners, they hired a vineyard manager to tend to the vines and provide counsel. During our interview, this young couple often stated that they left the vineyard management decisions to the "experts." Therefore, the things they learn about the wine industry come mostly from vineyard managers and to a lesser degree from winemakers or winery owners. However, many Domestic Vineyard owners are also highly educated, and some come with their own ideas and strategies about vineyard management. They play an important role in the Temecula Valley wine industry and reflect on the relationship between resources among the "expert" and "layperson."

In this chapter, I will cover the responses from stakeholders who are directly working with a vineyard or own a vineyard, such as a vineyard manager, domestic vineyard owner, winemakers, and winery owners. This chapter will cover how these stakeholders perceive different resources and communicate information, and how those perceptions affect production and the political ecology/economy of Temecula Valley Wine

Country. In addition, the chapter covers strategies used for best management practices and the conflicts caused by stakeholders over varying management techniques. Finally, this chapter discusses the challenges of collecting nexus metrics before providing a summary of the chapter.

Relationship with Resources: "There is plenty of water"

> If you're on this side of the mountain here, you're fine. There's so much water it's stupid. I mean there's plenty of water. (Joaquin Phoenix, Rancho California Water District Board Member)

Joaquin is part of the Temecula Valley wine industry in a position to influence land and winery purchases. Joaquin explains that the Rancho California Water District (RCWD) consists of 30% well water from nearby Pauba Valley, and the rest is imported or recycled. For water managers, well water is considered "sweet water" because it needs little processing to make it potable. Imported water for RCWD comes from the Colorado River with high salinity. Recycled water in this context is not reclaimed water from sewage systems, but runoff water such as reservoirs like nearby Lake Skinner (aka Skinner Reservoir) and Diamond Valley Lake (aka Diamond Valley Reservoir). Joaquin states that imported and recycled water is more expensive, alluding to the transport, treatment, and distribution of imported and recycled water for potable use. Yet, he repeated what many stakeholders would tell me even when they are aware Rancho California Water District pipes the water to their homes and wineries: There is plenty of water, and it comes from the aquifer situated below the valley.

This idea that there is plenty of water has influenced stakeholders' relationships with the vines and how often they should water. One chilly morning a vineyard manager,

Robert, pointed at the upright grapevine leaves. He explained that as the day progressed and the sun moves higher above the horizon, the leaves begin to droop. There is controversy among the laborers, vineyard managers, and viticulturists from Napa about the meaning of wilting leaves. Laborers and some vineyards managers felt this was the vines way of crying for a drink of water. In contrast, others believed this was a short-term preservation mechanism until the day gets cooler, like when people take a siesta after lunch to avoid the hottest time of the day. How stakeholders relate to the vine affected how they responded. Some vineyard managers would water the vines during the day to prevent wilting and what they called making the vine happy, while others would water in the early morning or evening to what they considered an effort to conserve water. Part of this decision making was the aesthetics of the grapevine vis-a-vis tourist expectations of lush vineyards in Wine Country.

The vineyards' aesthetics become compromised when El Niño is expected to pay a visit. Stakeholders acted like it was a visitor they were anticipating, some with dread and others with hope. Some stakeholders were looking forward to El Niño's visit, so the heavy rainfalls would wash out the years of salt accumulation that needed to be flushed out of the soil. However, in the clay-silty soils of Temecula Valley, all that water means erosion, which would remove carefully tilled soil and carve out long-forgotten intermittent streams. El Niño typically peaks in Southern California in late fall or early winter about every two to seven years (California Department of Fish and Wildlife 2019). Its arrival is predicted from weather patterns the year before when typically, cold waters in the eastern Pacific near South America's coast start to warm up. This event is followed by equatorial westerly winds to diminish and the Humboldt Current to weaken. Its arrival to Temecula

Valley also meant preparing the vineyards with erosion control consisting of long socks filled with hay. These buffers help reduce the speed of the water runoff but also change the picturesque aesthetics of the valley.

The Chief Mechanical Engineer for a local reservoir commented that vineyard managers probably preferred that it did not rain so that they can control the water application and the quality of the fruit. However, stakeholders complain about the dissolved solids in their water, which causes the soil to accumulate salts and minerals. When I asked Independent Vineyard Manager, Jackie Chan, about the quality of RCWD water, he responded, “Salinity… You can see it on the [irrigation] emitters because there is a little saltiness on it… and the price of Rancho water. They’re pretty high… They’re going up because of the drought.” Typically, he waters vines 8-10 hours a week, and that is applied in one interval or 5-6-hour intervals a few days apart, depending on weather and temperature. Most vineyard managers practice this routine from March until right after harvest in early November, and a few vineyard managers admit watering a reduced amount all year round even when the vine is dormant to allow for better intake of fertilizers when vines become active. Therefore, the winter rains from El Niño mean that the valley could be ahead of the water game, and could end watering restrictions and reduced water allocations due to the drought.

> Everybody thinks of El Niño is rain. But it's not. El Niño is a much bigger picture. But typically, in El Niño years, typically the rain part of El Niño comes in February and look at us. (Interview with Chris Pratt, Winery Owner and Winemaker on February 16, 2016)

Despite all the preparation, El Niño never came to Southern California in the winter of 2015-2016 even when weather experts presented strong indications that it would. The

local television news and the newspaper, *The Press Enterprise*, were presenting El Niño as a rescuer from the drought, and people were hoping it was true so they can get back to "normal." The El Niño watch began in the fall of 2015 and reminded me of the start of the hurricane season in Florida that encouraged people to prepare for significant storms. These news sources provided updates on rainfall totals and how people were preparing for the promised deluge by stocking up on sandbags and flood insurance. However, the "too big to fail" El Niño fizzled out by early February 2016. In his book, *The Dreamt Land*, Marx Arax (2019) describes the cost of California's water supply due to agricultural expansion and development. As a California native, he admits that residents suffer from drought amnesia. They forget that these drought events occur, and residences expect a reset of the rain cycle that comes from weather events, like El Niño. "Drought is California; flood is California. The lie is the normal… California, for a century and two-thirds now, keeps forgetting its arrangement with drought and flood… there exists a profound ignorance about where our water comes from" (2019, 514). In 2016, Temecula Valley's wine grape harvest was reduced by about 20% valley-wide. The rains finally came in 2017, and the harvest has been plentiful since, but for how long?

Unseen Energy

How vineyard managers and laborers responded to the vines also affected how they viewed energy in the vineyard. One cold dawn in late January, I was at one of the wineries helping the vineyard manager with the task of pruning the vines. I asked a few questions about energy to the laborer that was teaching me how to prune. I was expecting him to tell me of the propane-powered vehicles used around the vineyard and winery, or

the gas-powered trucks and generators that light-up the vines at night as we harvest. Since we were pruning, the only answer I was given was about optimizing a successful harvest by how the vine grows. In essence, he was talking of the grapevines' energy or ability through photosynthesis to produce fruit. Through pruning, I was helping them remove extra buds so the vine could concentrate the most "energy" to those buds that were left to maximize the flowers and grapes the vine would produce. His answer was unexpected. Later in the season, laborers will thin out the canopy, so there is enough air circulation, and shift the vine's "energy" production to the fruit rather than supporting new leaf growth.

Besides vines and vehicles, the only other form of energy used in the vineyard would be the laborers. Yet, they were only mentioned when there was a problem getting enough people to help with the harvest. Temecula Valley is old and small enough where most vineyards are laid out in grids that support labored harvest rather than the wider rows needed for mechanical harvest. This design means more vines, but it also means that winery and vineyard owners are dependent on seasonal laborers. One of the laborers I was pruning with admitted that he used to make more money as a carpenter working in the construction industry. At the time, California was still recovering from The Great Recession of 2007-2008, and the demand for construction laborers was sporadic. For vineyard managers, this meant that sometimes they could find the help they need, while other times, they were competing with another industry. This laborer stayed at this job for now, but he seemed to be looking for a way out, especially since he was not part of the "Oaxacan Gang" as one stakeholder named them.

The Oaxacan Gang was led by one of the Vineyard Managers who was from Oaxaca. He worked at several vineyards in the valley with his team of mostly men from the same area. They all spoke Mixtec and supposedly a little Spanish, although they would not speak to me in Spanish and sensed it was a means of their control. Why? I was not sure. While working with them, I was attached to an older Oaxacan laborer who also taught me how to prune. They commented that I was learning the right way of doing it, alluding to the other non-Oaxacan laborer who was helping me earlier. It was challenging to interview this group. They were great laborers in the field, and I won a little respect from them when they saw how I tried to keep their pace, whether pruning or harvesting or any other task. However, I sensed tension towards some of the stakeholders that made interviewing this group extremely difficult, possibly because they were an unseen or sometimes unruly source of energy in Temecula Valley.

Unseen because they are actively disguised and hidden from the tourist's gaze, but especially unruly when they create their own staff management rules that go against the winery's protocols for managing employees. For example, the wineries have to account that the employees have proper documents to work in the United States, as well as cover their workman's compensation. I heard rumors that, unbeknownst to the winery, a family member covers for the shift or the position for a vetted employee. This action may benefit the family and help the gang continue with their tasks, but it creates a potential problem for the winery with upholding federal and state employment laws. This scenario is one example of the metrics any employer needs to collect and how differences in culture and social status within and outside a group affect its quantification. Also, this scenario may explain the reason why these workers did not want to speak to me.

The Environment and the Vineyard: "They rather irrigate than have it rain"

> Wife: “Have you seen the model homes off of Pauba [Road]? They have citrus and they’re like $1.3 million. Well, I think their [Home Owners Association fee] is like $600 a month… and we have the potential of getting our money…”
>
> Husband: “Usually we’ll make money. This year, between tax write offs, we essentially broke even. We didn’t lose money. We didn’t make money… and we get to have the grapes…
>
> Wife: “and the view… It’s worth it.” (Scarlett Johansson and Chris Evans, Domestic Vineyard Owners)

This couple saw Home Owners Association fees (HOA) in fenced subdivisions as a waste of money with little return on investment when compared to the aesthetics and possible profit from growing wine grapes in their backyard. According to federal labeling laws (27 CFR 4.22, TTB.gov) and the Riverside County (Zoning Code 17.142.100, Municode 2019), 75% of the acreage of the winery has to consist of vineyards that will supply the grapes to make wine in the county or state of origin. However, to meet AVA labeling requirements for Temecula Valley, 85% of the grapes used in producing wine must come from the AVA of origin. Some of the first wineries in Temecula consisted of 5- to 10-acre parcels with a small tasting room and winemaking/barrel room, which allowed them to meet this requirement. As demand for Temecula Valley wine increased over the decades, so did the demand for larger vineyards and tasting and barrel rooms as well as the number of varietals offered at a winery. A winery’s diversity of wines when there is limited land means it has to depend on other sources for grapes.

Domestic Vineyards may serve an essential role in keeping the integrity of the Temecula Valley AVA label by providing wineries the harvest they need to meet the 85%

requirement of AVA grown grapes. In 2015, Temecula Valley saw a 40% reduction in harvest due to a combination of drought during bud break and severe storms during the flowering phase of some popular varietals such as Cabernet Sauvignon. To make up for the difference in grape tonnage needed to produce wine, wineries sought the help of independent vineyard managers to connect them with the harvest from Domestic Vineyard owners. Small Winery Owners and Domestic Vineyard owners may hire an independent vineyard manager to maintain the vineyard by irrigating, pruning, fertilizing, and applying insecticides. Independent vineyard managers also act as brokers to harvest and sell grapes to other wineries. This service allows residents with enough acreage and the proper residential-agricultural zoning to plant grapevines.

The benefits of becoming Domestic Vineyard owners, besides a profit, are state and federal income tax write-offs as a “farmer” and access to water at a lower domestic agriculture water tier. However, they also take the risks of paying Vineyard Managers $3,000-$4,000 per acre of vineyards per season only to break even or even lose money when there is a bad harvest. This couple broke even on this recently purchased residence with vineyard, but they also saw the potential for future supplemental income. In comparison to the new subdivision, they referred to, where homeowners would pay monthly HOA fees plus the management of their personal citrus grove.

Yet, not everyone sees the same profitability of growing grapes. Joaquin shared with me how he was shifting an old vineyard outside Temecula to ornamental plants. He said it’s “400 plants, each plant will propagate about 20 plants a year at four bucks. Do the math. It’s better than grapes. It’s cheaper for water.” Although this property is outside of Temecula, he has a position in the water board, which would be influenced by his

perception of water, and the value of vineyards in Wine Country. Another Vineyard Manager, Christian Bale, was shifting 20 acres of organic avocados outside of Temecula to lemons. While conducting my interview with him, we were driving to Fallbrook, located in San Diego County, about 10 miles southwest of Temecula. I was included in an informal conversation with the owners of an aging and diseased avocado orchard who wanted to transform the acreage to wine grapes to save money on water. The proposed grapevines would be grown within the South Coast AVA, which is a large swath that encompasses five counties in Southern California: Riverside, Los Angeles, Orange, San Bernardino, and San Diego. Temecula Valley is one of the sub-appellations located within South Coast AVA. However, for a winemaker to label the wine as Temecula Valley would mean that less than 15% of their grapes can be sourced outside of Temecula Valley. Depending on the varietal, season's demand, and market, grapes grown in Fallbrook may not fetch the same price as grapes from the Temecula Valley AVA.

As for energy, keeping rows clean and cordons high benefit the unseen energy of labor. Clean, unobstructed rows allow for laborers to harvest grapes quickly. As I was helping with one harvest, I was handed a small bin that I had to fill and then dump in the back of a truck with a tonnage bin, also known as a goat. To save *my* energy, the laborers instructed me to kick the small bin along the row of grapes, so I was simply cutting the grape clusters off the vine and placing them on the bin in the ground. Only when I had a full bin did I have to pick them up on my shoulder to dump in the larger tonnage bin. Doing this technique saved time and energy and allowed me to keep up with the workers.

Another observation and complaint I would hear from laborers and vineyard managers is the height of the wires upon which the cordons, or arms of a grapevine, are

Figure 6. Vineyards with cleared rows. More often Hispanic vineyard managers preferred rows that were clean to prevent obstructions during harvest and weeds from competing with the vines. They also state that this clean look contributes to the aesthetics of Temecula Valley and it is what the tourists want to see. Photo by author.

trained. A low wire meant laborers stooping over the vine and made the task of harvesting even more back-breaking. The next day I asked a couple of vineyard managers why one vineyard was so low while others were not. I heard two explanations; one was that it was

a Chinese method to maximize production and, he joked, they were short and did not know better. The other was that the vineyard has been under production for decades and accumulated soil over the years. There may be some truth in both answers, not of its foreign origin or shortness of people, but that they simply did not know any different approach since wine production is relatively recent in China. Many of these vineyards in Temecula Valley were started by amateur viticulturalists living in the valley, and agricultural techniques changed over the years. It takes a minimum of three years before a vine starts to produce and about five years to harvest a good crop, so vineyard managers do not make the decision lightly to rip up established vines.

Strategies: Technology and Nature

The drought plus the reduced harvest in 2015 had inspired people in the wine industry to embrace sustainable strategies in the vineyard. Temecula Valley practices soil moisture sensors, regulated deficit irrigation, cover crops, and reclaimed wine waste as just a few of the strategies to save water while increasing or keeping fruit quality. The first strategy, which has been around for some years, is uses soil moisture sensors known as tensiometers, which are buried in the ground one-quarter to one-third of the *maximum* root depth to register the water-holding capacity (UC Drought Management 2019). A solenoid can be added to connect the meter to an irrigation system. This technology has some drawbacks. The ceramic cup that registers the soil moisture has to be soaked in water for several hours and quickly dry out, so it can only provide data to say when, but not how much, to irrigate. Another drawback is when the sensors are not buried deep enough, since the roots of older, well-established vines can burrow 100 feet or more into

the soil. Vineyard Managers would complain the sensors were buried 3-8 feet deep when they needed to be buried 10 feet or more. They felt the vine's water uptake occurred at greater depths, which is why they are a drought-tolerant crop.

Due to the limitations of tensiometers, many Vineyard Managers were switching to inexpensive Electrical Resistance Blocks, referred to as gypsum blocks. These devices are permanently buried at different depths in the ground and measure the electrical resistance between two electrodes to monitor soil moisture to indicate when to irrigate. However, there is still the issue of how much to irrigate. The Vineyard Managers that use this device have more confidence in the accuracy of the data due to the multiple sensor depths. The data from these sensors are attached to software that allows the user to monitor soil moisture based on depth. These sensors are connected to small solar cells to power the meter and collect data.

Matthew McConaughey, a Domestic Vineyard Manager, saw the limitation of these devices, which is how much to irrigate, and was inspired to use his engineering background to improve the system. He created an irrigation network that uses multiple sensors to monitor soil moisture and temperature and transmit data using a low-power, long-range wireless network that can range up to 10 miles line-of-sight. This device allows Vineyard Managers to make irrigation decisions before stepping into the vineyard. Some managers that have used his system boast a 25% reduction in water use without affecting production. Part of Matthew's inspiration to create this device came as a way to save labor costs.

> There was also a, a cost saving, to be honest, because every time somebody comes out here to turn on the valves, it's $15. And later in the day he comes back, that's another $15. So I ended up paying more for the

> management over the irrigation valves than for the water itself. (Matthew McConaughey, Domestic Vineyard Owner)

The management over the irrigation valves he is referring to is the practice of Regulated Deficit Irrigation (RDI), which has varying techniques and requires an adequate amount of labor to turn the water on and off. RDI can be a consistent or variable reduction of water during the irrigation season. Temecula Valley practices consistent RDI since most managers irrigate the entire season at a minimum of eight hours a week. Vineyard Manager Jackie Chan mentioned he practices deficit irrigation on a couple of vineyards at the request of the owners, which he defines as stopping irrigation in July. This variable RDI technique ends irrigation during the growth phase after fruit set or right before harvest. According to documents produced by Terry Prichard from the University of California at Davis, a successful RDI is achieved with accurate soil moisture, crop demand estimates, and the ability to irrigate frequently (UC Drought Management). The idea is to take the vine to the limit of its water deficit tolerance, so energy is not spent producing a large canopy, which would cause further water loss from evapotranspiration through its leaves.

Another water-saving, but labor-intensive, strategy is cover crops. One winery in the Temecula Valley is experimenting with cover crops to prevent soil erosion, conserve water, provide nutrients, introduce beneficial insects, and aerate the soil. Their Vineyard Manager has influenced the use of cover crops among many Domestic Vineyard Owners. I observed resistance to this technique by other wineries for two reasons. Cover crops are best sown after harvest, and it changes the aesthetics of the vineyard. Sowing cover

crops in the winter comes with some risk since it requires irrigation or enough soil moisture for seeds to germinate.

> My gamble this year, you know, after being told that there is a 98% of El Niño hitting with a minimum of 14 inches of rain this year. I, you know, went to the seed store with pretty high level of optimism and said I'm willing to gamble to try and get really aggressive, not only perennials but some, you know, especially rye… it sends down really deep roots to try and break up some of that soil structures. It'll also tie up some of the salt ions in the soil and it will help to break up that magnesium layer. (Robert Downey, Jr., Vineyard Manager at Ponderosa Winery)

After the 2015 harvest, Robert planted cover crops in parts of the Ponderosa Winery and assisted Domestic Vineyard Owners to adopt this technique. Unfortunately, the lack of El Niño caused the cover crop to fail except in areas that were irrigated and served as an educational demonstration.

These types of natural soil and water conservation measures implemented on other agricultural crops are meeting some resistance since it goes against the picturesque image or expectations (or expressed terroir) of vineyard owners and wine tourists. The reaction over cover crops seems to fall among ethnic groups, with Mexican wine industry workers usually against the practice. Their idea of vineyard maintenance is “clean” aisles between rows of grapevines, which means removing vegetation mechanically through discing with a tractor or by using chemical defoliants or herbicides. Some even aggressively remove weeds that are taking advantage of the irrigation drip along the grapevine rows. The laborers and Vineyard Manager, Antonio Banderas, at Meyer Winery, said that the weeds stole nutrients from the grapevines. This idea is usually true with crops that have an 8”-12” root system, which is competing with weeds that grow similar root depths, but not grapevines with 25’-100’ root system. Cleanliness is what mattered to these workers, which later carries over to winemaking, while Domestic

Vineyard Owners with their smaller acreage see the cover crops as an addition to their vineyard aesthetics.

Figure 7. Harvesting by spotlight. Laborers cut grape clusters and drop them to the bin below. They kick the bin down the row to speed production. This method ensures the grapes are not crushed before delivering them to the winery. Laborers complain that the cover crops slow them down. Photo by author.

Researcher: “Do you use cover crops?”

Matthew: “Not on purpose [laughs]. But, uh, my neighbor, they till the soil. So you can check it, pass [him] next door, but… there's no, no growth there. It's just, you know, bare, bare soil. And I never liked that. So part of the deal with, you know, with [the Vineyard Manager, Jackie Chan] is that they don't, uh, disc the soil. So as a result, I have a lot of weeds. But I like it that way. So, I mow it every once in a while. And uh, and now I got talking with [Robert Downey, Jr.], and he said, yeah, that's good because you've got like life in the soil where you know, this guy kills everything.” (Matthew McConaughey, Domestic Vineyard Owner)

The final strategy covered in this study is the use of reclaimed “crush” and winemaking waste as a nutrient source. This technique is highly controversial and technically illegal. It will be covered more in The Winery Chapter, and demonstrates one way in which the flow of the Vinisocial Cycle diverts back into the vineyard. Vineyard Managers of some wineries like to compost the stems and woody remnants removed when crushing grapes to make wine. Composting is allowed on site, yet from my observations, compost piles were not as successful as they could be due to a lack of water. The stemmy parts of the grape dry up and are slow to decompose, leaving layer upon layer of past harvests.

A faster capture of nutrients comes from winemaking waste, which consists mostly of fluids. Typically, this waste is stored in a holding tank or lined reservoir. Some vineyard managers pump the waste from the holding tanks and spray it to the base of the grapevines, so nutrients are not lost. Nutrient loading refers to the anthropogenic and non-anthropogenic input of nutrients into an ecosystem (Environmental Literacy Council 2020, Mihelcic et al 2013). Many of the participants described this action of recovering nutrients for fertilization as the waste giving back to the vine to assist the next harvest. However, some policies make this practice illegal because rains can cause the nutrients to run-off into waterways resulting in excessive nutrient loading (State Water Board 2019). The winemaking process water has three waste constituents: nitrogen, biochemical oxygen demand (BOD), and salinity. Excessive nutrient loading of process water causes several problems. Excessive nitrogen application to land can cause the degradation of ground- and drinking water. Excessive BOD may cause nuisance odors if a water’s oxygen levels are sufficiently depleted. For example, one of the wineries lovingly refer to

their wastewater reservoir as Lake *Caca* (Spanish for poop). Finally, excessive salinity, coming mostly from sanitation chemicals, can affect the beneficial uses of water. Yet, stakeholders do not hold the same belief that excessive nutrient loading could happen since, to them, this nutrient recovery technique is no different from fertilizing or fertigation (liquid fertilizer introduced into a drip irrigation system).

However, these techniques may pose a greater risk to the vineyards themselves. Salinity, or dissolved solids, is something the rains help adjust or "wash out" from soils, so the problem becomes worse in a drought, mostly when harvest and winemaking occur right before Temecula's rainy season begins. Also, Dr. Carmen Gispert, who is the Area Viticulture and Pest Management Advisor for the Riverside County, UC Cooperative Extension, explained that reclaiming winemaking waste for use as fertilizer increases the chances of having mealy bugs. Mealybugs are sap-sucking insects that can reduce the production capacity and life of a grapevine. The sap-sucking also spreads disease, and the bugs excrete honeydew that encourages the growth of black sooty mold as well as the symbiotic relationship they have with ants, which tend to them like cattle. Mealybugs are slow-moving and spread from vines that touch. The more significant threat is when mealybugs are picked up on grapes harvested from one vineyard and survive the "crush" process before being sprayed along with the winemaking nutrients on another vineyard. Essentially, one winery's or vineyard's nutrient-saving strategy could create a costly pest problem to another vineyard and slowly spread throughout the valley.

> Well this year [2016] we have a, what we're guessing is somewhere in the neighborhood of a hundredfold increase in mealybugs in the valley. Mealybugs were a minor, occasional pest in small corners of a few blocks [of vines]. They're now almost everywhere. I'm spending more on mealybug control than anything this year. Um, I noticed a little bit of a resurgence of

> Eutypa [dieback]. It’s a viral disease. Um, I think overall the plants are being stressed. (Name not used to protect stakeholder)

This vineyard reclaims wine nutrients and is starting to see the adverse effects of this practice in some areas of the vineyard. In addition to mealybugs, Eutypa dieback is a disease caused by wood-infesting fungi introduced from pruning practices. The wounds left from cutting back vines leaves them vulnerable to disease. Sanitizing equipment is more expensive than merely shifting the time to prune to later in the year.

In contrast, less effort is made to harvest rainwater in this semi-arid region where it rains 12 inches per year. For some, this amount of rain is not worth the efforts to collect rainwater. One winery was forced to install rainwater harvesting because they were a new winery that was further away from the main RCWD water distribution line. As the owner of this winery states,

> Then we have the biggest aquifers, if you… well Rancho Water District has, you know, a monopoly and it's illegal for us to tap into. So I'm not allowed to dig a well, which is stupid, especially in the, in the situation we're in right now… Gosh, I remember 10 years ago watching [another winery], they had to pour concrete down their well. Sad, when you look at the fact that residential people can build, and dig a well, and we can’t, and we're in agriculture. That makes no sense, especially when we deal with the issues of chlorine…, so we have to get the chlorinators and filtration garbage to compensate for the water that they're supplying us. It's, it's really frustrating. It's just typical bureaucratic BS is what it really is at the end of the day. So that being said, when we were building and expanding the new winery… our general contractor came up with the idea of doing the rainwater harvesting tanks that are buried underground… And it had to be engineered and all the other BS. All the drains and all the gutters for all the building and everything for the new project. Everything flows in underground pipelines and fills into the [40,000 gallons] rainwater harvesting tanks… They fill up pretty damn fast. It's pretty, pretty surprising, so we have pumps hooked up. So that whole block over there [about two and a half acres] is really a hundred percent green, so that helps. So we haven't had any water issues yet as far as us. (Al Pacino, Winery Owner and Winemaker at Primofori Winery)

Al complains about his lack of water rights, and the bureaucracy of water management, even when he can collect acres of water and sees the benefits with his own eyes. While he can continually harvest rainwater, the other winery that was collecting and using reclaimed wastewater illegally can only collect it at harvest and winemaking events. For Al, the return on investment does not seem to offset the loss of his “rights” or freedoms.

In California, no individual or entity can own water, but they can receive a water right, which is legal permission to use a reasonable amount of water for beneficial use (State Water Board 2020, The Water Rights Process). Water rights laws in California are incredibly complicated because there are different forms of permission, and some are supported by old laws that were grandfathered in. To further complicate matters, individuals can “voluntarily” transfer water rights, and water districts can supply water to other water districts. The water provided to Temecula Valley is governed by the Rancho California Water District, which is a “Special District” established in 1965. The Cilurzos, who were one of the families that started the Temecula Valley wine industry, remember transferring their water rights to them in the 1960s. Before then, the valley depended on wells that tapped into the aquifer below. Today, the aquifer provides only 30% of the water supplied by RCWD. The rest of the water RCWD buys from The Metropolitan Water District of Southern California (MWD), which imports water from Northern California and the Colorado River (Rancho California Water District 2016; Metropolitan Water District 2020). So, one water district buying water from another water district to another water district.

If that was not complicated enough, water sources originating north of Southern California were diverted to save endangered fish (Sabalow, Kasler, and Reese 2016).

Reservoirs located at dam projects in Northern and Central California supply water to other parts of the state. Water levels had to be adjusted, or water flows diverted during the farmer's growing season to prevent the extinction of two endangered fish, Chinook salmon and Delta smelt. The fish needed the appropriate amount of cool water to survive. In other words, less water for people and more for the fish. Protecting the fish has been the greatest source of contention during the drought, especially with the Delta smelt under the care of the Bureau of Reclamation, who has not produced an effective resource management strategy during the drought. This failure has caused farmers to go another year with less or zero water allocation, including Temecula Valley.

Conflict between Stakeholders: "I water what I think the vine needs"

> Pues… normalmente, lo que le aplicamos es las ocho horas, dependiendo en el clima. A veces, que se pone demasiado caliente. A veces es suficiente días, una semana, le aplicamos otro día a la semana, si son ocho horas le podemos aplicar, este, poquito más, unas diez o doce horas, unas cuatro horas más de lo que se aplica por semana… (Antonio Banderas, Vineyard Manager)
>
> Translation: Well... normally, what we apply is the eight hours, depending on the weather. Sometimes, it gets too hot. Sometimes it is enough days a week. We [irrigate] another day a week, if it is eight hours we can apply a little more, about ten or twelve hours, about four hours more than what is applied per week.

The strategies used on vineyards introduces some of the conflicts encountered among stakeholders—for example, the issue of disease mentioned in the previous section. Information on best management practices for vineyards is usually homogenized to a statewide practice. I have heard Vineyard Managers complain that the practices are best in the colder and wetter climate of Napa in Northern California, where UC Davis often conducts its wine industry research than vineyards in Southern California. For example,

best management practices to control Eutypa dieback suggests shifting the start of pruning to February rather than late January. However, a few Vineyard Managers in Temecula believe that would be too late in the season to start since the weather could warm up enough for vines to come out of dormancy, so pruning at that time could introduce damage and disease to the vine. A few stakeholders in the Temecula Valley wine industry complain that information from the “experts” is too Napa-centric.

There were also tensions between Vineyard Managers, or Vineyard Managers, with Winemakers. Winery Owners were seldom openly observed to be involved in these tensions concerning the vineyard unless they were also the Winemaker. One example is demonstrated above, where the Winemaker orders for vines to be watered 8 hours a week, which is standard. Jackie Chan, as almost everyone in Temecula Valley, states they are staying within their water allocation. However, Antonio, the Vineyard Manager, insists that the vines need more water, especially when they are young. He waters up to 12 hours per week during the active growing cycle, depending on the weather. The other vineyard managers’ report using much less water. Antonio might be the only stakeholder admitting to the accurate use of water since none of the stakeholders could show me water use metrics unless they owned the land. In wineries with medium to large production, water use metrics seldom pass down from the owner, or person paying the water bills, to the people managing water use in the vineyard unless there is a problem.

Most of the tensions occurred during harvest, which is a stressful time of year. Grapes have to be picked at appropriate sugar levels, or Brix, and this window of opportunity is only open for a few days. Brix levels can quickly fluctuate from unexpected rain or too much irrigation. Antonio explains, “[Javier] tells me, ‘You know what? This one

[varietal], don't put any more water on it because we are close,' and sometimes when you put on the water when we are near the Brix, sometimes the sugar will drop." Because of this fluctuation in sugars, harvesting has to occur quickly, starting as early as late July or early August with white wine grape varietals until late September or early October for the red wine and late harvest wine varietals.

The equipment needed during harvest includes trucks with beds to hold tonnage bins and light equipment that lights up large sections of the vineyard. Harvest occurs in the evening hours when the temperature is cooler (60ºF on average), which prevents the grapes from spoiling or begin fermenting with the natural yeast on their skin. In essence, the desert evening chill provides similar refrigerated conditions as those found in the winery. Also, chaptalization, or enrichment, is not an option. Chaptalization is when sugar is added to low alcohol wine before or during fermentation, which results in a higher alcohol level after fermentation (MacNeil 2015, 52). Sugar is rarely added to wine in Temecula since the warm climate allows grapes to meet the necessary sugar levels to ferment a full-bodied wine. The process is generally frowned upon in the wine industry because adding sugar gives a fake, alcoholic boost to wine flavor, which is the taste of some non-grape, fruit wines. However, when sugar levels are high, Winemakers can add water to grapes. For best results, most Winemakers want to avoid adding too much water, which is why it is crucial to time the harvest correctly.

It does not take great skills to harvest grapes, but one has to be quick, and it is back-breaking work. The workers divide the amount made per ton after the broker gets his cut, so the goal is to reasonably harvest as many grapes in an evening, which means visiting two or three vineyards a night depending on the grapevine block size. I helped to

harvest a couple of blocks in 2015 and again in 2016. Laborers in the valley are typically male migrants from Mexico, although in the early days of the wine industry, there were women field laborers. Not all of the laborers work in the wine industry regularly. The harvest season requires more laborers, so laborers with experience reconnect with people in the wine industry, or others congregate at specific locations in the area to work as day laborers.

During the day, many of these men work construction jobs and then harvest in the evening. They mention how the money they make during harvest allows for a great Christmas for the family. For them, it is worth working two physically demanding shifts for two and a half months of harvest just to get financially ahead. Laborers are usually jovial and tease each other while picking fruit. When another female student and I started to help, they were concerned we would slow them down. We were determined to keep up, and we showed the men that we were quite capable of being part of the team. The Vineyard Manager teased us and joked how he was going to get more work out of the men because they were trying to impress the women.

This jovial behavior at one vineyard completely changed when the crew agreed to work in a different vineyard. Everyone was quiet as the laborers began to harvest the grapes. There were not joking around with each other and, instead, there was even more hustling to get the job done. When I started to help pick the grapes, I quickly realized the problem, even with my limited knowledge of vineyards. The grape clusters were small, and only one-third to half the fruit was large and fully ripe, which meant a lighter load and less pay. I just started doing my research on the field, and I was not sure what was going on. I questioned the Vineyard Manager in charge of the harvest crew, and he confirmed

that the grapes had not reached their full potential. A different Vineyard Manager was in charge of caring for these grapes throughout the year, but it was these laborers that would pay the price of his managing. As far as the laborers were concerned, they wanted to hurry up and move onto the next vineyard to make up for the loss.

Later in my research, I learned that the situation was more complicated than it seemed. The Owner of the vineyard, who also owns a winery, had a particular way he wanted to grow his grapes. One can argue that it is the responsibility of the Vineyard Manager to educate the Vineyard Owner about best practices that would provide the highest yield. However, this is where one person's idea of terroir conflicted with best management practices suited for Southern California grapevines. The tensions I observed were between competing Vineyard Managers and laborers, even though the Vineyard Owner also lost profit. Over the months, I learned that the Vineyard Owner was an older gentleman who had lived in Southern France and had his ideas of the wine he wanted to produce. Irrigation of grapevines has a negative connotation in France because it will disturb a grape's terroir.

The Vineyard Manager with the harvest crew was trying to win his business over from another Vineyard Manager to increase grape production for the next harvest. After all, it was not just the money for the laborers, but also a source of wine grapes from the Temecula Valley AVA, which means an abundant harvest could make-up (or back-up) another winery within the AVA. When I interviewed the Vineyard Owner, he would not share too much of his philosophy on viticulture with me. The original Vineyard Manager mentioned how the older gentleman had a different way of growing his grapes and just

left it at that. Maybe the Vineyard Owner wanted to grow his grapes as they do in France, with little to no irrigation and in tighter rows that only allow human laborers?

Another example of tensions between Vineyard Managers and laborers is the use of cover crops. As I mentioned earlier, the men taught me to save energy by kicking the grape collecting bin on the ground along the rows of grapevines. Laborers hate cover crops, not only for the lack of “cleanliness,” it demonstrates, but also because they become entangled in the weeds. Typically, cover crops include soil nitrogen-fixing legumes that vine across the rows and over the other types of cover crops, like rye, which break up the soil and provide organic material to soil when plowed. Even though the cover crops build the nutrients and water-holding capacity of the soil, the vegetation slows the workers down and can cause injury from tripping or spraining muscles. Even if the vegetation was tilled, or disced, which usually happens before harvest, the cut vegetation slows bin-kicking, as I soon learned.

Then there is the issue of labor. The more vineyards and wineries there are, the more labor is needed during harvest. U.S. immigration policies have caused a strain in relationships between laborers and the wine industry. In 2015 and 2016, Mexico’s economy was getting stronger, and fewer people were migrating across the border during harvest season. According to older laborers, younger Latino workers in California did not want to work in the field. Instead, they opted for non-agricultural jobs at McDonald's and elsewhere that offered the new fair wage increase of $15 an hour over piecework based on total tonnage per vineyard that would often end up paying less than $10 per hour of hard labor. For some years now, wineries have threatened to switch to mechanized harvesting to reduce their dependency on seasonal harvest labor even though they say

it affects the quality of the fruit. Only one winery refused to consider switching to mechanical because the Winemaker understood how that would affect the laborers financially. In addition, the harvesting equipment is expensive, so at the time of this research, only one large winery had purchased one that was barely used, partly because it also required vineyards to be planted with more space between rows to use this equipment.

There are also tensions over land, which also affect labor. The popularity of Temecula Valley Wine Country has inspired people to make it their home. The beginning of these development decisions was covered by Dillon-Sumner (2014) in her Master's thesis. From a FEW nexus standpoint more residents in the area remove agricultural land and potential vineyard production unless the residential parcels were acreage zoned to sustain the designated agricultural uses. Homes with acreage are often located behind wineries or at the edge of Wine Country. However, Temecula Valley can have some steep foothills where enough land can be cleared for a home, while still having enough, though steep, land for grapevines. Depending on the varietal, a seasoned Vineyard Manager can plant grapevines in steep terrain, but not necessarily in rows of trellises. Instead, they stake individual grapevines and head train them, which means growing them like miniature trees. The vines look like a stick poking out of the ground with arms flowing up and out. Even wineries use head training to add a few vines in small strips of land between developed spaces. It is only suitable for specific varietals that produce well with a compact footprint. However, these techniques also mean a dependency on labor to prune, fertilize, and harvest.

Figure 8. Homes and vineyards. This house was constructed at the periphery of the valley where the rocky terrain makes planting vines more challenging. Photo by author.

Water allocations are calculated for every RCWD customer. This number is based on the type of land and use. For example, water allocation for a residence is calculated based on the square footage of their home and the number of people living in the home and combining it with the square footage of their yard at a different rate. The same calculation is done for vineyard owners, which have the land for the vineyard and any buildings to support the industry, and in some instances, including a few residences located within winery property. Each group of water users has a different rate and a meter for each depending on use, like Residential, Domestic Agriculture, Agriculture, or

Commercial. The goal for all of Temecula Valley is to stay under the yearly water allocation. If they go over, then they pay a higher tier, but there are few incentives for saving water.

Meanwhile, residents living outside the wine-growing region expect vineyards to do more to conserve water, or at least carry an equal share in water use restrictions. Installation of new sewer lines in 2016 to accommodate the push to develop more wineries in the valley presented an opportunity to add reclaimed water lines. The Chief Mechanical Engineer stated that there is more residential demand for reclaimed water than there is means to accommodate people. However, he was not aware of any measures to use reclaimed water on vineyards. In addition, stakeholders may hesitate to use reclaimed water on the wine grapes without knowing the risks. The University of California Cooperative Extension released the results of an eight-year study to test the response of vineyards irrigated with reclaimed wastewater (Weber et al. 2014). This study comes from a push from the Napa Sanitation District to maximize water recycling in Napa County, including vineyard irrigation. The study demonstrates that there is no buildup of salinity or ion toxicity, and discusses the benefits and challenges of the nutrients available in reclaimed water. However, the study does not evaluate the introduction of ingredients in personal care and pharmaceutical products that could accumulate in the plant and transferred into the fruit. Furthermore, the demand or use for reclaimed water may have different results in Southern California, demonstrating some of the Napa-centric research carried out by the experts.

Challenges to Collecting Nexus Metrics

On the surface and based on the available literature review of LCAs of vineyard management, collecting nexus metrics should be straightforward. GIS, soil moisture data, weather patterns, fertilization, amount of irrigation, and even labor are all things that can be easily quantified by Vineyard Managers. However, the conflicts among stakeholders involved in vineyard management demonstrate challenges in collecting nexus metrics. Best management practices are sometimes at odds with personal relationships with grapevines, specifically with stakeholders' views of vine health and ideal aesthetics. These relationships with vines carry on to affect relationships with other stakeholders in the wine industry. For example, a Winemaker can give instructions regarding watering, which the Vineyard Manager ignores based on his relationship and years of experience with the vineyard. These conflicts in relationships include skepticism with research tailored to winegrowing outside of Southern California.

Energy use is centered around the grapevine with little consideration of labor unless in a negative connotation. The industry complains about how hard it is to get laborers, but do not credit how laborers drive the industry. In addition, Vineyard Managers blame each other for poor watering management or vine management that affect the quantity and quality of the fruit. As demonstrated with these conflicts, nexus metrics that focus on fruit production can dismiss the socio-economic impact of and on labor. Labor is seldom considered in FEW Nexus literature on the wine industry, and most wine research in the United States is Napa-centric. However, an LCA on vineyards in California (Steenwerth et al. 2015) could demonstrate the possible outcomes if Temecula decides to change its vineyard management, which would require improving labor relations.

Napa's vineyard management philosophy is quality over quantity, which translates to higher prices per bottle and potential, although constructed, scarcity. Napa Valley, located in Northern California, lay their rows tighter to allow a small truck for harvest but requires a large amount of labor (Steenwerth et al. 2015). In contrast, Lodi, located in Central Valley and supplying wine grape juice to Temecula Valley, focuses on quantity and uses more machine equipment. Rows are spaced further apart to make room for machine harvesters, which means all the space has to be utilized to gain maximum profit. Lodi "backs up" many wineries around California in addition to having their own wineries. Temecula Valley wants to be the next Napa, and Steenwerth et al.'s (2015) LCA study demonstrate how Temecula Valley could maximize the available land by focusing on the quality of the fruit at lower yields. However, these results depend on their labor (hand-harvesting, cover crops, composting), and Steenwerth and colleagues do not discuss labor relationships since they are working merely from nexus metrics. Moreover, the results are not perfect. The trade-off is higher energy use (labor), water use, and global warming potential per metric ton of grapes. According to Steenwerth et al. (2015), increasing yields is the default response, but doing this will not reduce emissions. They suggest that alternative strategies need to be developed to offset the negative impact on the environment.

Chapter Summary

In this chapter, I begin tracing the Vinisocial Cycle of the wine industry by introducing the vineyard and the stakeholders that intersect this space. The diversity of stakeholders and their educational background seem to influence how each person

responds to resources, especially in terms of the vineyard, water, and labor management. Laborers are concerned over the “energy” of grapevines while their own energy use and knowledge get dismissed by stakeholders with roles above theirs. It is easier to collect basic nexus metrics in the vineyard since products already have flow rates to help with calculations. However, this area also demonstrates the social aspects that can prevent dependable results of nexus assessments. Primarily, there are conflicts in vineyard, resource, and labor management, as well as varying perceptions about resources and priorities over resource use. In the vineyard, stakeholders also seem to have the space to experiment with solutions, like nutrient recovery strategies and rainwater harvesting, either voluntarily, illegally, or unwillingly.

Chapter Five

The Winery

> They're doing this out here… So, you know, when you see 120 wineries out here, I don't see how [Temecula Valley] is going to do it. They don't have the space. (Chris Pratt, Winery Owner and Winemaker at Persian Winery)

This study continues to follow the flow of wine to the wineries where grapes are crushed and turned into wine. This study shifts its focus from stakeholders that work in the vineyard to people that work in the winery, specifically Winery Owners and Winemakers. The chapter begins with a discussion of the interrelationships stakeholders have with grapes as they are turned into wine, and the energy and water used throughout this process. As this chapter demonstrates, stakeholders at the winery have a completely different attitude about resources. While stakeholders working in vineyards were reflecting on nature, winery stakeholders were focused on the control and artistry of winemaking. These interrelationships with resources affected stakeholders' views of the wine industry and response to scarcity, as well as conflicts between stakeholders, which influence the collection of nexus metrics.

Relationship with Resources: Less Water More Energy

> Researcher: Do you think there is enough resources, especially water and energy, to be able to handle… [the Wine Country Community Plan]?
>
> Edward: Absolutely not. Well, and I always say, is it possible for small wineries like this to go in at a 120? Absolutely not… I guess there's people out there that want to have a vineyard in the, I call it either the trophy in the

> trophy structure, or they need to write off the taxes… You know, they have some other big [project]… so they want to write off some of their expenses and they, so they open a winery up. It's a financial strategy. A report has it… that 50% of the wineries do not make money. 50% of them. And I presume that would be statewide or something like that.
>
> So, you know, when you see 120 wineries out here, I don't see how [Temecula Valley] is going to do it. They don't have the space... I mean, there's vineyards in other parts of the state of California that are larger than this entire valley… Because theoretically there's a… a code… 75% of your property has to be under production, and 50% of the grapes have to come from your own property. That's jumped around a little bit, but how can you do that? I mean there's a lot of land around here… but right now… especially like a year like this,… for example, I bought a three tons of grapes from [another vineyard]. They couldn't deliver on it,…so I bought… 3.25 tons to make up for my Cab loss… from Lodi and I brought those grapes down. (Edward Norton, Winery Owner and Winemaker at Eureka Winery)

The land was one of the central themes with Winery Owners and Winemakers because it directly affected the Temecula Valley AVA. Like many of the first wineries that started in Temecula, Edward has a 10-acre winery with a cozy little tasting and barrel room, rather than the large tourist complex that was being built across from him that included villas. Edward was explaining to me the hardships of getting grapes when there was a 40% reduction in harvest, especially of the popular Cabernet Sauvignon grapes. Small wineries have to depend on other wineries to “back them up” as a way to offer a diversity of wine varietals. In other words, only a percentage of his acreage is planted in Cabernet Sauvignon, so he can also plant other varietals, like Chardonnay, Tannat, and others. At the time, Tannat was rare to find in U.S. wineries and is one of the varietals that set his winery apart from the rest in Temecula Valley. Edward expressed his concern of the consequences of not having enough land under production, especially to weather storms and droughts.

Figure 9. Pockets of empty land. Temecula Valley has areas to develop more wineries and vineyards, but stakeholders question if there is enough land for 120 wineries that include tourism complexes. Photo by author.

The other theme among Winemakers is controlling the recipes of winemaking. Each wine has a recipe, which includes how many grapes to use, how long grapes were macerated (soaking in their skin), what type of yeast was used, and on and on. When a winery changes to a different Winemaker, the recipes are technically the property of the winery. However, as I observed, each Winemaker wants to make their mark, so they tweak the recipe to improve the wine or create a whole new flavor. In addition, many Winemakers in Temecula Valley do not have a formal viniculture degree, but instead learned on the job and supplemented their knowledge with any available workshops

offered by organizations like UC Davis or the Wine Institute. Dwayne Johnson is a Winemaker at Bearrs Winery, which is a large and established winery that has catered many events over the decades. He shared his experience when he started getting into the business of winemaking:

> I worked for a Winemaker who wouldn't tell me a thing. I had to watch and learn. Um, he would not share the secrets, and I learned the secrets because I watched carefully and… very talented. Um, brilliant man. Um, well educated, uh, uh, scientist, uh, pioneer in the industry. But you, you had to watch him because he didn't share and he was paranoid, but I don't, I don't… On a blend, the only one I tell that we put things in is the Meritage, because we belong to the organization. Everyone wants to know what you put into… what went into this blend, what went into this blend. Like it's there right. Coca-Cola doesn't tell you what they put in. So that's our gig. I don't tell what the blend is. If you can figure it out how to make the wine, all the power to you. (Dawyne Johnson, Wine Maker at Bearss Winery)

During interviews, few Winemakers mentioned creating recipes to complement the terroir of Temecula Valley. Instead, competition among Winery Owners and Winemakers centered on who had the best, award-winning recipe, which is closely guarded. The exception to this rule is Meritage, which are Old World Bordeaux-style blends created in the New World. To label a wine as a Meritage requires a license from the Meritage Alliance, which is obtained by sharing the recipe to demonstrate the blend consists of only “noble” Bordeaux varietals and that no varietal consists of more than 90% of the blend. Meritage wines were becoming increasingly popular to the point that some wineries in Temecula Valley were thinking of growing more Bordeaux varietals, especially minor or rare varietals like Carménère and Petit Verdot, which even in small amounts, contribute to the flavor of the wine. This decision helped strengthen the relationship with Domestic Vineyard Owners, who could grow these varietals to meet demand.

Aside from grapes and recipes, when there are separate roles in medium and large wineries, Winery Owners seem to have a significant concern over water and energy use than a Winemaker working for a winery. Winemakers focus on making good wine as part of their resource management decisions. I expected to hear concerns over energy bills increasing from Winery Owners, especially from those owners that are also winemakers. It takes a significant amount of water to cool electricity-producing plants (Gleick 1994), and wineries have specialized, refrigerated equipment to make wine. Anyone can see the stainless-steel wine fermenters filled with wine glistening under the hot California sun as they make their way through the valley. The fermenters are surrounded by a glycol system that regulates the temperature of the wine that is inside. Most of the older wineries have outgrown their interior winemaking space or have re-purposed the space for larger tasting or barrel rooms. This winemaking equipment has become part of the scenery of Temecula Valley Wine Country.

The fermenter is chilled with a glycol system that coils around the silo-like structure. This system ices over on the outside of the silo to keep the appropriate temperature inside (~60ºF depending on varietal). A few wineries have blanketed these silos with insulated covers to save on energy, but this practice has a couple of issues. Winemakers and Winery Owners complain that the Southern California sun deteriorates the cover material. Also, the cover sometimes holds the melted ice and does not completely dry out, causing mold to grow, which also breaks down the cover and turns part of the silo black and sooty. These issues have prompted many wineries to opt-out of covering fermenters. One Winemaker bluntly stated that they do not see a return on investment, but rather more of a hassle in the long run. Another Winemaker wanted to

use the covers to save energy, but admitted, “It doesn't look as pretty, and that's going to be important too, because they're working on making this more of a destination, right? Well, what does the public want to see?” (Dwayne Johnson, Winemaker at Bearss Winery)

When wine fermenters are kept indoors in tank and barrel rooms, it helps chill the space, which is kept at about 65ºF year-round. Yet, the energy needed to refrigerate wine products or the winery was seldom brought up in interviews unless pointed out by the researcher. Even the use of alternative energy was something that had to be prompted in an interview. Since it is Southern California, one would think that solar panels would be an excellent way to offset the energy demands of a winery. However, few wineries took advantage of installing solar panels, despite federal tax incentives designed to shift people towards the use of alternative energy. It was clear that the wine industry was not concerned over their consumption of electricity at this moment in time and some cases, not even water, if it means sacrificing the quality of the wine.

> Researcher: Do you see the water bills for the winery as a Winemaker?
>
> Javier: When I first got here, I did…But I try to see everything, I’ll say in whole, in regards to the fruit. Sometimes I see the cost having a straight relationship with yield. So, if my yields and the quality of the fruit goes along… I’m okay with that, so, no I don’t pay much attention solely on the cost of water… If we see the cost of the water by itself, it does creep up on a yearly basis. But if I see it like that, then… I’m not paying attention to the quality. At the end of the day, I’m focusing on making wine and I’m trying to make the best one possible. (Javier Bardem, Winemaker at Meyer Winery)

This attitude about water leads to the third theme, cleanliness, which was an important behavior among Winemakers. Although not quantified, Javier was observed using the most water, both in the vineyard and the winery, when compared to others in the valley. In the winery, cleanliness was crucial because leaving wine residue behind

would allow for yeasts and bacteria to become established in a winery and make it difficult to remove. There are several organisms that can be introduced into the wine at various stages of winemaking or bottling that can develop foul smells and odors. One is the bacteria acetobacter, which gives wine either a nail polish or vinegary aroma. In Temecula Valley, only wine and products made from wine, like brandy, are allowed to be produced in the valley. However, wine vinegar is not one of them due to the high risk of acetobacter contaminating wine for drinking.

The other organism, which was of significant concern to Winery Owners and Winemakers, is the “wild” yeast Brettanomyces, or Brett, which is responsible for a range of aromas described by Winemakers as “Band-Aid,” “barnyard,” “horse blanket,” or “manure.” A small amount of Brett can enhance the flavor of a wine, and give it regional characteristics, as is often the case with Old World wines, especially those from Italy. However, New World wines are expected to have a “cleaner,” more orchestrated flavor. Therefore, Winemakers see even the smallest amount of Brett as a huge flaw. A Winemaker often asked me, “Have you gone to [so and so]’s barrel room? Did you notice a peculiar smell?” This exercise was part of my training in identifying Brett. I was also invited to join Winemakers to attend a Brett workshop on a procedure that could detect Brett. Ironically, outside of Temecula Valley, the burgeoning craft breweries of the City of Temecula often use Brett-laced barrels in beer-making, particularly in Lambics and Saisons, to add a spicy or tart flavor.

The presence of Brett reflected on the cleanliness of a Winemaker’s establishment. Therefore, pointing to the presence of Brett in a barrel room was a way for the Winemaker to brag about his own establishment and management skills and to criticize the skills of

the Winemaker at the affected winery. From the moment grapes are harvested and delivered until bottling, every single piece of equipment is meticulously cleaned, and this requires a significant amount of water, as Simms (2013) demonstrated in his research. Since Brett is “wild” yeast, it is introduced to the barrel room from spores in the air or on the grapes. One of the first things that occur in winemaking is pouring a sulfur solution on the grapes to kill naturally-occurring yeast so that the Winemaker prevents yeasts from competing with one another during fermenting and thus tarnish the taste of the wine. The process was described to me as an artist prepping the canvas for paints.

Figure 10. Steam cleaning barrels. To save water, wineries use steam and pressure to keep their wineries immaculately clean. Cleanliness prevents unwanted organisms from damaging the wine. Photo by author.

Another opportunity for Brett to infiltrate wine is when it is barreled for aging, so it is important to have clean barrels, which are re-used year after year until the barrel can no longer be used. The volume of water used in winemaking is included in the commercial water allocation of the winery. Winemakers were not concerned about water usage during “the crush.” because it was an annual event that lasts a few months. Also, water use is much less compared to residential use (Simms 2013). According to Simms,

residential zones require 1.6 acre-feet per year when compared to the 1.5 acre-feet per year by wineries, and this difference increases with the projected growth of each zone. However, as Javier said, in the end, it is about making the best wine.

The Environment and the Winery

> The problem isn't the amount of wineries… it's the lack of vineyards that are here... since we're located between San Diego and L.A., the amount of people that are going through your winery is staggering compared to other wine regions. Just staggering. And you're going to find out very quickly that you're going to sell out a year wine very fast… And what's going to happen is that 75% rule is gonna go right out the window. So you're only limited to the amount of growth as the, the amount of grapes that you have. So instead of putting wineries in, they should be planting more vineyards... You can cram full of wineries here and then pump juice from, you know, up north and bring it down here and then make the wines. And you can definitely have wineries and everything and that will offset the use of water and resources in the valley, because it's coming from elsewhere. But you're shipping all that stuff down here and so you're not preserving the Temecula experience in wine. You're diluting it. And so I, you know, I don't know how far they thought of this or how, so yeah, wineries are fine. But what's more important is vineyard development. (Patrick Stewart, Winemaker at Ponderosa Winery)

Patrick was reflecting on his 40% reduction of harvest in 2015 and what the Wine Country Community Plan would mean to Temecula Valley AVA wines. He works at a medium-sized winery that is quickly growing. Like Edward from the small Eureka Winery, he would like to see resiliency in grape production because it would mean resiliency for the winery and Temecula Valley. Also, as the Winemaker that is in charge of the Vineyard Manager, he would like to have control over the quality of grapes he will use in his recipes. He associates terroir with the "Temecula experience in wine."

Unlike the vineyards, where stakeholders had a direct relationship with vines, bugs, weeds, and the sun, wineries provide a controlled environment catering to

consumers' wine experience. In the beginning, wine tasting rooms were part of the tank (if fermenters are kept inside) or barrel rooms. The room can stay comfortable as long as not too many people occupy the space and heat the room. Heat can hurt wine and negatively affect the consumer's experience. The increase in popularity that occurred at Tahiti Winery, which is a small, but very well-established family-owned 10-acre winery, forced them to make some changes to their winery.

> We didn't have the tasting room as a separate part of the winery. Our winery used to just be open, and the doors were left open all the time. And so people came in and tasted in the winery, so the tanks and barrels were in the same room and the door was open. So I'm closing off that tasting room space and keeping the winery closed up and separate. Energy was, again, was a concern, but the primary thing was trying to elevate our tasting experience, honestly. (Ben Kingsley, Winemaker at Tahiti Winery, and son of the Winery Owner)

Despite modifications to the tasting room, there is a large glass window that allows tasters a glimpse "behind the scenes." The Winery Owner of Tahiti Winery explained how they wanted to install solar panels to offset the refrigeration costs as well as "for a moral sense," however they cannot justify the cost of the installation at their small establishment.

In the end, the winery focuses on the needs and comfort of the consumer through its ability to have enough good wine, which reflects Temecula Valley's terroir. Therefore, it is essential to keep winery spaces balanced with cool temperatures and humidity.

Strategies: Cleanliness is Everything

> Would I like to see the water bill? [laughs] No, I do not want to see it… well, I take that back… I guess my initial reaction would be 'Wow!'… comparing it to my home, [but I] have to look at it realistically... Saying a portion of that is vineyard, a portion of that is just in facilities, and then landscaping and whatever. So until we meter out, I don't know. Yeah, we are metered out.

> Yes there is a separate water meter for the vineyards. Until we see that percentage taken out from the total. That's the part I would like to see… There's not a meter on the water that we use [in the barrel room]. However, what I've done in the past is… we figured out how much water is used per job. (Patrick Stewart, Winemaker at Ponderosa Winery)

Because of the drought, many wineries were re-thinking how they conducted specific wine-making cleaning processes to reduce water use, since, as Tahiti Winery mentioned, solar energy strategies were not as cost-effective. However, water-saving strategies impact energy use at a winery by either increasing electricity use or reducing the hidden energy of labor. This section discusses two of the main strategies observed and mentioned in interviews: power washers and steamers.

At the beginning of my data collection, wineries would use less water and more labor by brushing winemaking debris to waste holding tanks with a broom. During this time, they were calling me the "water police," and they were monitoring their own behavior. However, wineries go through tons of grapes, and keeping up water-conserving appearances started to cost them time and labor. Once they were comfortable with my presence, stakeholders began using more water to rinse off the equipment and the floor, because it was less labor-intensive, and some wineries used more water than others. To save on their water use, many wineries started using power washers and steamers to clean equipment. To them, the initial investment of purchasing the equipment was reasonable for the results. Power washers used to rinse inside silos and floors made labor more efficient, while power steamers used less water and sterilized equipment, specifically barrels before they were filled with wine.

The most use of equipment came from wineries rather than vineyards, even during harvest. On a day-to-day basis, the Winemakers can have about two to six people on

staff, depending on the size of the winery. Therefore, equipment makes the task of making wine much more efficient. As Al Pacino explains, “we haven't had any water issues yet as far as us. Again, we use the steamer, which we use like 1/50th [of the] water.” Even though many stakeholders are adopting water-saving strategies, most of them feel water is invested in the vineyards rather than in winemaking.

> A small winery like mine, part of our sustainability program is to watch that water use and get the right equipment that uses less. So I do a lot of steam cleaning, you know, high-pressure washing. We really use a minimal amount of water in the processing. And certainly, you know, little to no water goes into the wine itself. Like in beer, it takes a heck of a lot of water, and that's just the way you make it. It’s… really, the water usage that we're concerned with here is, really, it’s what goes into the ground and comes into the facility as juice in the grapes. (Chris Pratt, Winery Owner and Winemaker at Persian Winery)

Chris is one of the Winery Owners that promote sustainability by being a member of the California Sustainable Winegrowing Alliance. The Alliance offers a sustainability program that encourages sustainable practices for managing resources. Wineries often use this designation for marketing wines as “eco-friendly.” Although water-saving strategies saved on water, the focus of stakeholders seemed primary on getting the most cleanliness in the winery with the least amount of labor.

Conflicts between Stakeholders: Who has Control?

> Researcher: What is keeping you from having your own vineyard management?
>
> Dwayne: Time and money. I think it's actually cheaper than what I would do to have outside management. And it's what the owners want to do with their money and that's understandable. And I don't wish to do it for free either.

> Um, I'm already busy, and I don't wish to be twice as busy. (Dwayne Johnson, Winemaker at Bearrs Winery)

Conflict among stakeholders seemed about control over resouces and metrics. Three themes stood out depending on the role of the stakeholder, specifically whether they were a Winery Owner or a Winemaker. Winery Owners controlled how quantitative data, like water and energy use, were collected and shared. Winemakers controlled wine grape quality and quantity, and the recipe. However, the goal of both stakeholders is to make a bottle of good wine and increase demand. There was less friction between these two stakeholders within a winery than there was among these stakeholders at other wineries.

The Winemaker is often in the middle, managing laborers in the winery and vineyard, as well as taking instruction from Winery Owners and meeting consumer demand. As discussed in Chapter 4, the Winemaker wants to control the quantity and quality of the wine, and they do this by communicating their needs for wine production to Vineyard Managers. Chapter 4 also demonstrated how laborers could rebel against instructions based on their perception and relationship with resources, not as a means for sabotage, but to improve wine production and vineyard reputation. In many cases, I observed actions that the Winemaker was not privy to, like the vineyard manager watering more, and this allowed the Winemaker and Winery Owner to have the illusion of control. During my participant observation, I seldom witnessed laborers in the winery taking independent actions, other than when they show up and take breaks. No one decides to stop wine from fermenting without instructions from the Winemaker.

Winemakers sometimes struggle to meet consumer demand since wine can take almost a year, two year, or more, depending on the varietal and style, before it is bottled

to sell. For example, during this research, Rosé wine was making a strong comeback. So Winemakers had to shift their order of grapes or come up with an innovative new recipe with the grapes at hand, like White Cabernet that mimics the sweeter flavors of the French Rosé Cabernet d'Anjou. The Winemakers' and Winery Owners' struggle comes down to whom they aim to satisfy. If the Winemaker or Winery Owner decides what the consumer would like, this is known as the "seller's expression." Winemakers and Winery Owners are also sensitive to consumer demands for varietals and blends such as Meritage. Often wineries try to achieve a balance of both.

A few Winemakers wanted more information from the Winery Owners to help them make decisions on whether to take a risk on a new recipe or to offer suggestions to improve the winery, such as for the purchase of new equipment or marketing tactics. It was difficult for younger Winemakers that had to prove their skills at established wineries with older owners. For many Winemakers in Temecula Valley, skills were acquired on the job and not through formal training in viniculture. The variety of education levels caused tension among Winemakers that were trying to create wines that will set their winery apart.

Collecting Nexus Metrics: "We took off the water meters as soon as he left"

Shortly after Simms (2013) finished collecting his dissertation research on water use during winemaking as part of his study on the political economy of the wine industry in Temecula Valley, the water meters he provided were removed from the facility. It is not clear by whom, since it is my understanding, the Winery Owner was pretty hands-off. It is probably safe to say that this was the actions of the Winemaker and his crew. One of the crew members later became a Winemaker at another winery, yet he did not volunteer to

add water meters to manage water use during production. He was willing to use whatever water was necessary to make good wine and keep the work area clean.

This example also demonstrates what often happens with engineered solutions. Whether they are devices to help track resource use or solutions that bypass human behavior, one of the frustrations of people working in sustainability is this resistance to collecting quantified data or nexus metrics. Devices are often removed shortly after because they hinder some accustomed behavior. This specific resistance in the wine industry seems to come at two levels. The Winemaker does care about water conservation, but not enough to quantify water use and often blames the most water use

Figure 11. Unmetered water use. Winemakers are more concerned about making a good wine than worry about conserving water. One winery removed internal water meters used to calculate their water use outside of other commercial use within the winery. Photo by author.

on the vineyards. However, Winemakers are also concerned over the amount of land under production, which requires water.

Winemakers did not quantify many resources aside from bottles of wine produced, the wine recipe, and making sure to have enough ingredients, most importantly, grapes. This action is done despite the fundamental business model of knowing ALL inputs (the resources used in production) to calculate the price point of a bottle of a wine appropriately. This calculation is a fundamental business practice to know the return on investment (ROI). So, either it was not transparent that the Winemaker, or Winery Owner, was collecting more quantified data, or they are actually "feeling out" the use of resources and, therefore, prices for wine.

Chapter Summary

The winery seems to contrast the vineyard. For example, calculating production seems straight-forward in a vineyard. If metrics are correctly reported, one can calculate how much water and labor is used in a vineyard and compare them against the actual use. In contrast, wineries, especially medium to large wineries, can hide their production costs among their tourism sector. At this level, the power dynamics seem to change. Part of this shift shows a resistance to collect or sharing quantitative data, which may be intentional. In addition, it was harder to pinpoint perceptions as to why they are making individual decisions, maybe because they feel it contributes to the quality of the wine. Their management decision helps them stand out, and this is where terroir seems like an entirely socio-economically constructed concept. In addition, labor for the winery facility never seemed to be an issue like it was in the vineyard. However, one cannot exist without

the other. There was never a shortage of people to help in the winemaking process. People would offer to volunteer for bottling with the promise of taking a bottle or two home for their efforts. Students learning viniculture would intern at a winery. That is not to say there were not student volunteers during harvest but I worked with fewer students in the field. The primary concern was getting enough grapes, and this is where labor (as discussed in Chapter 4) and the land were crucial. Both of these resources affect the quality and quantity of grapes to make wine.

Chapter Six

The Wine Tourism Complex

> Robert: It can rain starting at five on Tuesday, and it can go to… I'll even give up the morning of Thursday, but it better be sunny from 12 noon on Thursday to five o'clock on Wednesday. We're good. Let it rain on Wednesday. I'm fine. No one's out. No one's here Wednesday, the slowest day of the week.
>
> Researcher: And otherwise the drought hasn't impacted you, like monetarily, in any other way?
>
> Robert: Like it's helped us. It's actually helped us, in my opinion.
>
> Researcher: How?
>
> Robert: By getting more tourists here. When, when it's 80º in February, my God, people love it. And they're having a blast and they spend more money. So, yeah. So, this was a rainy day, right. And I can track them. We track it. Yeah. If we have a slow weekend, you know, and they'll see the numbers. I say, I bet we got rain on that day. Sure enough, they look back and we track our weather to sales, to, to all this stuff, right? Cause we have, we do that for, okay. Last year, this time we had this many people, so we need to staff accordingly. (Robert DeNiro, Winery Tourism Complex Owner, Ponderosa Winery)

This chapter follows the flow of wine into the tourism complex, which was one of the largest development drivers for the Temecula Valley Wine Country. The Tourism Complex consists of facilities other than the winery and vineyard, like restaurants, hotels, and large outdoor entertainment for concerts and weddings. These facilities attract massive crowds and allow people to spend the day at one winery in Wine Country rather than just taste and leave, or hop from one winery to the next. Winery Owners and their

Figure 12. Inviting landscapes of wineries. Local residents enjoy the lush landscapes provided by wineries while for some their lawns at home were turning brown because they couldn't afford the increasing cost of water. Photo by author.

marketing team offer the romantic vineyard landscapes and unpretentious appeal of this wine region to lure consumers to come and play for a day or more.

Weddings are a big hit in this area, and due to demand, they required supporting facilities to accommodate such events. At the beginning of Temecula Valley's tourism development, wineries had just event spaces and restaurants. However, as I was conducting my research, some wineries were building private villas that could house the wedding party and their guests, making it an ideal destination wedding location. They expanded their wineries over the years. One winery under construction was designed

entirely from the beginning as a Wine Tourism Complex. Stakeholders also heard rumors that one Complex with a large swath of land located at the far edge of the valley would also provide apartments, which would be a first for the valley. This Complex caused much concern in the valley because the other wineries could not compete, and they feared it would irreversibly change the agricultural zoning on future development.

During my research, I was able to tour one of the beautiful villas during a Bridal Expo. I used the opportunity to observe if any messages of sustainability were shared with the audience. The marketing for these wedding packages centered around luxury and romance. What was missing was anything to suggest to consumers that their actions during their stay could save water or electricity. Even if a bride could not afford to have the wedding in Temecula, she could at least have her Bachelorette party where the future bride and her entourage could be transported from one winery to the next in a stretch limousine. Mid- to Large Wineries that offered wedding packages loved having a young crowd enjoy their winery rather than Las Vegas, which is only a four-hour drive away. However, the servers, especially male servers, cringed on their arrival. They shared their experience with the Bachelorette parties that did not care to learn about wine, seldom tip, and sexually harassed male servers. Not exactly the “Disneyland” that Winery Owner, Bill Wilson, had envisioned for Temecula when he supported the Wine Country Community Plan (Yelvington, Dillon-Sumner, and Simms 2014).

Before Robert made a comment quoted at the beginning of this chapter, he mentioned how a steady 1” rain for about four days would flush out the salts and minerals in the soil, make his vineyard manager happy, and produce quality grapes. Yet, as a former businessman in the corporate world, he sees the silver lining of a possible

environmental disaster, even if the economic gain is not sustainable for the long term. This chapter will demonstrate how the expansion of the wine tourism industry is impacting several stakeholders in the wine industry, the conflicts between stakeholders, and how the Wine Tourism Complex affects stakeholder's interrelationship with wine, energy, and water. This chapter will also demonstrate how Temecula Valley's tourism wine industry affects people outside the industry, yet engage with the wine region in some form or the other. These people include residents as consumers and local agricultural businesses that can support the valley.

Relationship with Resources: "It just takes a little more thinking ahead"

> Researcher: So, what do you think would be the best use of water in Temecula wine country?
>
> Chef Ramsey: I'd be open for more residential personally, but I know the way it's zoned out here, it's mostly agriculture. So, if you build anything out here, from what I understand, you'd have to have a minimum so many acres of some kind of agriculture. I don't know if it has to be grapes, but it has to be something out here.
>
> Researcher: Why would you do residential?
>
> Chef Ramsey: It's a nice place to live, I think with residential though, you use less water. I don't use water at home like we use here. There's no way… Just what I use, you know, back in the kitchen and how many times a day we wash our hands. You know, being back there, I know me personally when I'm messing around with food and stuff in the middle of the day, I'm coming to wash my hands at least every 15 minutes if not more. So, I mean that's a lot right there, you know, and the pots of water and the dishwashing and you know, washing your vegetables and there's a lot of water. (Gordon Ramsey, Head Chef at Ponderosa Winery)

Chef Ramsey was very aware of water use at his restaurant. As part of the Executive Order, restaurants were only allowed to serve the restaurant patrons water upon request, rather than automatically fill a glass. During my stay, this was one of the

few changes they made that was observable by a Temecula Valley consumer. As I frequented the local restaurants, the staff shared how they thought this order was a joke. In their opinion, a guest not drinking one glass of water that was served to them would not make a difference when there are more significant issues to resolve. They felt it was a performance for restaurants to show they are sustainable during a drought. Most restaurants in Temecula Valley served their guests water without being asked. This small act by servers, and possibly management, was also a demonstration of rebellion or opposition to the Executive Order. However, not everyone in the restaurant business felt the same way. Chef Ramsey explained how he changed his behavior.

Figure 13. Saving water as a performance. Few wineries and hospitality venues advertised their water- or energy- saving efforts to customers. Photo by author.

> Researcher: Do you make any decisions about conserving water or energy at the restaurant… just in the day to day?
>
> Chef Ramsey: I mean, kind of common-sense things. Um, [it] used to be common practice to where if you had to thaw something out, you would put it in a container, turn the cold water on and let it run so the water circulates. And it was no big deal. You know, um, that's health department friendly. But now with the drought you kind of see that water just running and running and running and it, it could take an hour. So now we're more conscience of, okay, I'm going to need this tomorrow or the next day. So, let's go ahead and take it out of the freezer now and put it in the fridge and let it thaw out in the refrigerator rather than waste the water. So, it just takes a little more thinking ahead.

The Health Department allows restaurants to thaw food using running water, which could take several hours. Chef Ramsey explained that he could place it in a bucket of water and change out the water every so often, but he would violate code and risk getting people sick. Instead, he chose a more time-consuming approach by letting the product thaw out in the refrigerator. This behavior change also means Chef Ramsey switched from a water-intensive technique to an energy-intensive one, which includes his labor as well as the cost of electricity to power the refrigerator and space allotted for defrosting food. He would have to plan how much meat or seafood he would need at least a day ahead.

However, his point-of-view about the quantity of water used in a restaurant is in contrast to the message winemakers and vineyard managers share about wine grapes. This message of wine and wine grapes as a water-saving agricultural product carries on in merchandising that is stocked at their stores. Many of the small wineries may carry a minimal amount of merchandise to supplement their income and the consumer's experience. The merchandise is typically items made by a local artisan, like candles, jewelry, or clothing. Mid- to Large Wineries have a shop as you enter the establishment or set aside as its own room in the Tourism Wine Complex. It was this merchandise that inspired the name of my research during my pilot study because I would find dish towels, small signs, and t-shirts that would state - Save Water Drink Wine. However, none of the items were branded to Temecula Valley. Interestingly, much of this merchandise was hard to find while conducting my research. I could not find out if it was a marketing decision to

come across as drought-sensitive or if they merely ran out of inventory due to greater demand.

My experience with the store was friendly and fun, and focused on supporting the main economic driver, which is the wine. As consumers enjoy any sized winery, they are encouraged to become Wine Club Members. Typically, wineries ship two bottles every other month, which allows the member to continue to enjoy Temecula Valley and its wine. As a Wine Club Member, I usually shared my wine with friends along with my adventures researching in Temecula Valley. Later I realized how I was providing the best form of advertising, which is word of mouth. Wine Club Memberships and tracking attendance against rainy days were just some of the ways the wineries would decide how much wine to make. Interviewing stakeholders focused on the tourism portion of the wine industry made me realize the level of disconnect with stakeholders behind the scenes (i.e., laborers, vineyard managers, and winemakers). These tourism support stakeholders were focused on the consumer's experience, which made me wonder how stakeholders viewed wine.

Is Wine Food?

> "I think having a, um, a viable wine industry is probably better for this area than having a viable citrus. You know, nobody wants to go to a citrus orchard and look at Orange Trees, you know, I mean, that's not much of a draw back. Everybody wants to go to a winery and taste wine." (George Clooney, Winemaker at Key Wineries)

To understand the FEW nexus in the wine tourism industry, I had to understand how stakeholders in Temecula Valley viewed wine as food or concerning food security. So, I asked, Is wine food? Surprisingly, most stakeholders were thrown off by the

question. Yet, how can I study the interrelationship of resources that make up the FEW nexus of the wine industry without understanding how participants view wine as food.

Out of the 37 people interviewed, 34 participants answered this question. Almost 2/3 of the people considered wine food (n=19), and two participants answered “yes and no.” These two participants best represented the struggle that some people had with this question, as though no one never asked them to reflect on the nature of wine. They often had to think out their argument as they were answering my question. Sometimes participants needed to come back to the question later in the interview because they were trying to decide on a definitive answer to the question. In contrast, others started saying no, but while thinking it through, they started to have doubts. I grouped the answers into 15 different categories, which reflected three perspectives of value: nutritional value, social value, and economic value.

Nutritional Value of Wine

Of course, since the participants work in the wine industry, they understood that wine came from wine grapes, which is an agricultural product that is not eaten like typical table grapes. Wine grapes are completely different varietals with attributes consistent with making wine, while table grapes are sweeter and juicier. A popular table grape is the Cotton Candy® produced not far from Temecula. A few of these table grape varietals are used to make juice and jellies, like the well-known Concord grape. There was consensus among stakeholders that grapes are food, even though not all agreed wine was food. For those participants that believe wine is not food, then the question becomes at what point does it stop becoming food? And why?

Seven classes of terms were most often used to reflect on the negative or positive nutritional value of wine. Thirty (30) participants discussed the nutritional value of wine when considered as food, with most participants answering that it had some form of nutrition and pairs with food. Those people that answered “no” (n=11) were considering the nutritional value to support their answer, while two participants saw it as a luxury item or unnecessary for survival. Two of those participants that did not think wine was food were chefs that work at restaurants in the winery. “I don’t think wine is food, no. I think it augments food and food augments wine, but I don’t think wine is food” (Interview with Chef Gordon Ramsey, Ponderosa Winery).

Both chefs I interviewed felt wine enhanced food but could not see it as a particular food product. One of the chefs is a sommelier who provides informal classes at a local winery. Sommeliers learn about wines and terroir to be able to make recommendations of which wines to pair with food, but the course only focuses on the characteristics of the wine. Rarely is food provided to be able to pair food and wine, so there can be a mismatch if the sommelier is not holistically trained, which is a complaint of some Winemakers in the valley.

It is difficult to understand where the line is drawn between wine and food. I was not prepared for some of the responses in order to follow up on questions. The question that began as an ice breaker question felt more like a philosophical debate about wine’s existence, and in turn, the function of the wine industry. From a nutritional point of view, wine, as we know it today, does not provide the necessities for survival. This vineyard manager summarized the struggle with this question best.

> You know, one of the basic things that people need, you know, food, shelter, to be in as part of that kind of Maslowian lower scale of security. And in that

> respect, [wine] is not [food], because you do better off probably drinking fruit juice than you would wine. In the aspect of food being an expression of culture and an expression of who we are in the natural world, I think [wine] is one of the highest forms of food. (Robert Downey, Jr., Vineyard Manager, Ponderosa Winery)

This question needs further study to understand whether taboos (Douglas 2003) associated with wine, especially in the United States with its history of prohibition, influence the reluctance to consider wine as food (Pinney 2007). In Europe, wine and beer were preferred over water because, in centuries past, the fermentation process helped reduce the risk of waterborne illness (Maynard 2014; Grigg 2004). Technically, water has no nutritional value as well. The nutritional label of bottled water will have no calories but has added trace minerals to improve the taste. Water is something we are made of and need to replenish in our bodies daily. An argument that an enthusiastic wine lover can also make about wine. When participants stumbled on the question if wine is food, I often used milk and orange juice as comparisons because they were industries present in Temecula and foods included in food pyramids. In hindsight, a better comparison would have been tea or coffee, which are touted to have the same phenols as wine, and are equally mood-altering depending on the amount ingested by consumers.

Social Value of Wine

The next most common category used amongst the 34 participants interviewed was social value, how wine brings people together, or how it can be viewed as something other than food (n=14). Most participants discussed wine as a social drink that enhances food and the quality of life as long as it is not in excess. Of the 14 participants who answered this question, two naysayers argue that it is a luxury item or something for

recreational use, but not food. One of the oldest Winery Owners in Temecula summarized it best:

> Yeah, it's in just about every wine-drinking portion of the world. It's a major part of people's meals, and food and socializing in most cultures go hand in hand. Wine is an integral component [of] that plus wine complements food so well…. I don't drink every day, but I mean, when we're having a special meal or a meal that I know we're going to engage with people or spend time with people or each other…, we always include wine because it complements the food, it complements the conversation and it complements the interaction between people. (Gary Cooper, Winemaker and Winery Owner, Tahiti Winery)

Just as wine is a social drink, a couple of participants saw wine as a living organism. Interestingly, this comment came from Vineyard Managers rather than Winemakers. Vineyard Managers monitor the health of the vines and often comment about “sad-looking leaves” when leaves wilt because they have closed small openings (stomata) that prevent water from evaporating during the heat of the day. I was not expecting participants would extend the life of the vines towards the grapes, especially after being picked and fermented into wine. This response of wine as a living organism is what I would expect from the Winemakers. The Vineyard Manager that best articulated the complexity of whether a wine was food also teaches viniculture at a local college and leads a sommelier group. I sat through his classes and regularly attended the sommelier group and met with many of his students. He always expressed the vineyards as an ecological system that needed to focus more on microbiomes and how humans interact with the microscopic world to produce grapes and wine. While other participants would finally come to a definite conclusion to my question about wine as food, he was able to accept that it is both a food and not food.

> It's such a refinement of taking a natural product and superimposing our capacities to change to... Well, there's two things with wine, there are two kind of interesting paths you can take with wine. One is you can strive to get out of the way and let the natural microbes express what was in the vineyard. The other is that you can express the sort of human influence, which is the seller's expression. (Robert Downey, Jr., Vineyard Manager, Ponderosa Winery)

Wine also aided in recruiting stakeholders. My experience participating in a sommelier class helped me gain participants' trust and brought us together as a community. This small group of about 20 people consists mostly of Domestic Vineyard Owners that want to learn more about the wines that are made from the grapes grown on their property. This class was taught by Chef Woody Harrelson and Robert, the Vineyard Manager mentioned above. A few of the attendees work in the wine industry's tasting rooms, restaurants, or wine distributors. Other wineries in the valley provide their own sommelier classes to their staff. This class was a little more inclusive by recruiting Domestic Vineyard Owners and students from the local community college interested in the wine industry.

Figure 14. Wine tasting. Photo by author.

The sommelier group was a safe space to know nothing about wines but have a genuine interest in learning. It was also an affordable class because the cost of the wine was divided among the group, and costs depend on varietal and region. The most I paid for a class was $20, and that was typically for French Premier and Grand Cru wines.

Sometimes those in better economic positions will chip in more so more people can enjoy the experience. It was often quite entertaining to describe a personal sense of taste with the goal that the person will taste the wine the same way, or at least understand what the other person means. Maybe this was what Jefferson envisioned when he wanted wine to be the democratic drink at every American's table.

Economic Value of Wine

The value with the least response from participants that are involved in the wine industry is the economic value of wine (n=11). Respondents that answered the question – Is wine food? - justified their answers by labeling wine as not a necessity to survival, a luxury item, or a means of income. Respondents answered this question with fewer economically charged answers relating to cost, and those that made references to economics were reflecting on building the wine industry. For example, one Winemaker states: "You have to encourage [wine as part of a lifestyle] if you want to sell your wine. And a lot of what I say is obviously marketing, you know, marketing-driven, just kind of beat into you" (Ben Kingsley, Winemaker, Tahiti Winery).

Then there is the Seller's expression. The Winemakers shared their wine with me to get the response of a potential consumer of their product. There was underlying reciprocity. I was trying to gain trust and build my social capital within the wine industry. They were trying to market their wine, maybe to educated women that place more thought into the products they consume and would be open to the Winemaker's direction or expression.

Although economic gain or value was the least concern of wine as food, based on their answers, an anthropologist can see that all these categories have an economic value of some form. The participants may have focused on nutrition since it is connected to food. It is why we eat. For wine, it is a form of negative and positive capital because it adds value to the quality of life, but too much can be detrimental, like a drunk uncle at a wedding. Social value, or social capital, means sharing wine with friends to strengthen those bonds that can help with future transactions. Even though the participants understand that other foods can provide all of these things, they also know that it would not be at the same price point. Wine is a luxury that these people want to "bank on." Hence, Domestic Vineyard Owners plant wine grapes rather than olive trees or any other agricultural product, or Winery Owners diversify their portfolio with the hospitality industry to sell the sunset view of a vineyard.

The Environment and the Wine Tourism Industry

> I see Temecula has been always a bit of a… you know, it's people come through. You're driving from LA out to Palm Springs. You cut through. It's, it's an easy stop. So our tourist traffic is, is so much different. Our model is so much different than any of the other appellations anywhere, because they have a certain amount of isolation. You know, we're isolated, but I see us as an island within this big sea of people versus, you know, these big seas of open space and agriculture where the people are more of the islands. Like you go to San Francisco, I mean, you still got to drive an hour north to go to Napa, to go to Sonoma, and it's not, you know, people who live there. They may not think much about going to wineries because it's very old hat to them, but it's there and they're not necessarily the tourist traffic. Whereas I think people who come to LA and they've got a Disneyland, oh, we're going to drive down to San Diego, got a Lego land, we'll go to Sea World, we'll go to Tijuana, go to Mexico. You'd become so much different. I think this area is very different in that respect to why our tourism is what it is. (George Clooney, Winemaker at Key Wineries)

Key Wineries was the largest Wine Tourism Complex at the time of my research. The Complex includes a restaurant, villas, and a spa, and makes the perfect weekend getaway for many tourists from San Diego and LA. Since my time in Temecula, a couple of wineries have met or surpassed its size. The focus on tourism complexes comes at a cost. Land that is easy for stakeholders to plant and manage is being allotted to villas, restaurants, and lots of parking. The increase in tourism has caused a greater demand for water and sewer as well as congested the small country roads. While I was in Temecula Valley, they were upgrading the sewer system since many wineries were dependent on septic. Switching to sewer helps free up land that would be dedicated to a septic tank and drainage bed. A sewer system also guarantees that waste is managed correctly. One of the concerns of health officials is the lack of maintenance of septic systems, which can leach untreated nutrients into waterways.

Temecula Valley was also upgrading its roads. A discussion was taking place about widening roads, which was a significant concern for people that lived in the area. Temecula Valley already had problems with drunk driving and people driving fast down the narrow-paved roads. The residents and even people that worked in the Valley were concerned that there would be an increase in fast traffic when they would rather have slow traffic that flowed smoothly through the valley. At the time of my research, there was only one street light as you enter the Valley from the Town of Temecula. When the wineries closed, traffic would get congested for a long stretch. To make matters worse, one of the wineries near this light would have evening concerts and run out of parking. People’s patience was tested as almost the entire road and right-of-way would turn into a parking lot.

For the moment, there is enough right-of-way to handle the congestion, but the town has decided to invest in beautifying the right-of-way to increase aesthetics. This may change if the road is widened. While the Town is ripping up their established landscaping along the roads to comply with the Executive Order, Temecula Valley is receiving a face-lift. The Town of Temecula is switching to drought-tolerant landscaping to reduce its water use. Temecula Valley is adding drought-tolerant landscaping from the beginning. In the end, both areas should use about the same amount of water per linear foot, however some residents did not see why Temecula Valley would add landscaping rather than wait for the drought to be over.

The beautification is to lure more investors into Temecula Valley, no matter where they came. At the time of my research, China was increasing its wine consumption thanks to its strong economy. This demand inspired some Chinese business people and companies to look into purchasing established wineries or land to build wineries in Temecula Valley. A few stakeholders were concerned they would buy what little arable land was left at the entrance of the Valley and build something that would change the ambiance of the Valley. In truth, the fear of this conservative town was not knowing who their neighbors would be, or what techniques they would use to build their wineries, especially when their economy provided them with more spending power.

In contrast, some of the new wineries were started by young professionals who made their fortunes in the technology industry. These wineries could invest in state-of-the-art equipment and often employed young stakeholders that learned the ropes of the wine industry, giving them their big break to make a name for themselves. This arrangement benefited the young investor who could use the stakeholder's social capital

to gain trust from other wineries in the Valley. The wineries would be classified as mid-range for this study, with the minimum vineyard area and a compact winery footprint. For example, one winery had their barrel room on the first floor and their tasting room, which offered food, on the second floor. The height allowed the winery to take advantage of the view. This layout is in contrast with most wineries in the Valley, which sprawled out their establishment among their acreage.

Strategies: "Free energy to chill with"

The response of the stakeholders in Temecula Valley seems to contradict the response of the State. Even after the Executive Order, people made statements that there was plenty of water – maybe as a demonstration of resistance from a predominantly conservative community against a Democratic governor, or to keep their perception of water rights, or both. This response adds to the complexity of overcoming infrastructure management gaps. During my pilot visit, I witnessed only one sign or message for water conservation. It was not located in the hotel room, as has become the norm in the tourism industry, but instead, it was in the men's bathroom of one of the wineries. The sign over a waterless urinal educates men that one urinal flush has the equivalent amount of water to irrigate one grapevine for an hour. A similar sign was not located in the women's bathroom - yet - which housed low-flush or dual-flush toilets. However, the ultra-water-saving urinal did not last long, for one of the basic reasons that many sustainable features do not last. Cleaning the urinal requires a change of behavior.

The cleaning staff at this winery with the waterless urinals consists of Latin women. One woman complained about how she wants to use cleaners on the urinals, like any

other urinals, to have a sense that she is accomplishing her level of cleanliness, but she cannot. She also has to train the rest of her staff not to do it. The waterless urinal has a thin layer of hydrophobic sealant, which allows liquids to slide down the drain, hence removing the need for water. The surface stays dry, which prevents odor-causing bacteria from growing. The urinal is cleaned by misting with a neutral cleaner and wiping down until dry. Any water with harsh chemicals that are used on the urinal or dumped down the drain can breakdown the protective barrier. Some of the men's restrooms were starting to cultivate a certain aroma. The urinals caused enough grief that they replaced them during my stay.

Aside from water-saving equipment for public use, the Winery Tourism Complex could benefit from installing solar since they would have a larger electric bill from entertaining the tourists. Solar panels could be installed on taller buildings so as not to impede the aesthetics of the winery. However, few tourism complexes installed solar panels, for the same reasons that the small mom and pop wineries cited. The Facilities Manager at Ponderosa Winery, Daniel Day-Lewis, explained it best.

> Researcher: How about like alternative energies? Have you considered solar or anything?
>
> Daniel: Alternative energies. It's been two years since I got the last bid on it… I think it was like four bids from different contractors who were proposing to come in and install some kind of system and everything that they proposed [had a] return on investment that was much further out than what they were saying. Because when you start looking at what they're actually saying they want to try and do, um, it wasn't what I would call real world numbers either. [They're] coming up with a perfect scenario and if it's this way, you're going to get this money. Yet, I could pull up a history of, you know, just the weather and show them what the weather is showing that is different than what they're saying… they're trying to say that you're only going to have, let's say 30% of the year at this temperature, so air

> conditioning isn't going to be necessary. Kind of things like that. And you can just look and see that's not the case. I am consuming more electricity than [the solar panels] are able to produce, so I'm still having to tap back into the grid.
>
> The other side of it is, um, the equipment that we use for harvest and for making the wine is very energy consuming, and unfortunately it needs to be run during the hottest part of the year. Harvest happens during late July through September, the hottest parts of our year. And I have to be able to take [the wine into the fermenters] in the middle of the day and I have to get it cold. Edison [Electric Company] tried to work with us, well, what if we did stuff at night? They're offering discounts too. I can't! I have to do it when I have to do it. The return on investment for solar was so far out that it really wasn't, it didn't make sense for us to invest the money there.
>
> Researcher: When you're talking about if it's far out, are you talking 20 years or…
>
> Daniel: It was between 15 and 20 years… and then by then is the panels still viable? Do you have to replace it? At what point do they degrade and now you gotta get a new one? It's just, it really is everything. I started asking them about it. It's like I was hitting a wall and like just, I couldn't come up with [a reason to go solar].

Solar and waterless urinals were not the only strategies used in this tourism complex. Daniel even worked with his refrigeration contractor, who developed a glycol system that can chill the wine more efficiently while cooling down space. It was a double-walled bath system where the outside glycol system would be close to the ambient temperature of the room, while the inner coils cooled the fermenters to about 23 degrees. It was like a step system. He noticed that soon after installing this system, his compressors were not running as frequently. "[The glycol system] produces what we consider free energy to chill with" (Daniel Day-Lewis, Facilities Manager, Ponderosa Winery).

As I was interviewing Daniel, I felt that he was genuinely trying to incorporate water and energy-saving technologies to improve wine production and the tourists' experience.

All the restrooms have water-saving features, the dishwasher in restaurants recycles its water for so many uses, and they incorporate high steam sanitation to balance the water used by consumers of the tourism complex. He was in charge of the water meter that runs the facility and not the vineyard. Since the vineyard does not use electricity, he was in charge of that utility as well. He took his position very seriously. However, in Daniel's mind, the winemaking uses the most resources of water and energy, even more than the tourists that come to visit.

Conflict in Town and Country

> I can see the difference when I'm not irrigating and when I am, especially the drier seasons, [I] have my [vineyard] blocks off for an entire week. [Irrigation at the event space] cycles daily or, or twice a week. So, I can look at the water use from one week when I'm not using it, see how much they use. And it's about 50% of that meter. They're using as much just to water the lawn here as I am to keep 25 acres of grapes going. (Robert Downey, Jr., Vineyard Manager at Ponderosa Winery)

The "drier season" Robert is referring to is during the winter and early spring when vineyards need little to no water. His comments are in contrast to those of the Facilities Manager, who believes that winemaking uses the most resources, and maybe that is what he is witnessing since the irrigation is not metered out from the rest of the facility. As a Vineyard Manager, Robert would like to have more access to water for his vineyards. However, he also understands that the tourism sector of the wine industry creates demand for more grapes and, in turn, his services.

Studying resident's perception of water in contrast to the Temecula Valley was outside the scope of my research; however, there were a few opportunities that repeated the tension between town and country. Marx speaks of town and country as though they

are miles away from each other (Foster 2000); in this case, the town and country are adjacent to one another and are the same country town. In addition, boundary limitations are one of the issues with any form of Systems Thinking approach causing a potential risk for the researcher's reductionist results to be incorrect or incomplete. The researcher is deciding what parts of this system to include in the study.

That said, I limited the physical boundaries of my research to Temecula Valley to focus on the American Viticultural Area (AVA) designation and local zoning restrictions. However, Temecula Valley, as a "wine country," cannot fully exist without the town of Temecula. Some wine industry businesses are actually in the town, like tasting rooms in Temecula's downtown area called Old Town, the Temecula Winegrowers Association, and even contract winemakers that are affiliated with more than one winery. The greatest conflict between the stakeholders came from residents and agriculture outside the valley that had to share some of the same resources, especially water, with Temecula Valley.

I lived with a couple of people just outside the valley during my time in the field. One was my friend, Maria, whom I met in the 1990s in Orange County. She and her family moved to Temecula right before I moved back to Florida. This was years before the Internet, and text became accessible and affordable for everyone. The time difference made keeping in touch a little tricky, but we managed to keep in contact, nevertheless, without the help of social media. When I lived in Orange County, Maria was my neighbor, and I practically lived in her home. I helped her care for her young boys while our husbands were at work. So, when I had to research Temecula Valley, it made sense to rent a room from her so we could catch up. She still lived in that late 1980s, Southern

California, single-story home with a small front and backyard in one of many planned communities.

My friend was explaining what it was like to live under the water restrictions. She understood that it was based on the size of the house and lot. The Water District used satellite maps and GIS to calculate the square feet of a home and the yard. The Water District used this technique for every one of its clients, including the wineries. The Water District also asked residential customers how many people lived in the home to calculate how much water should be allocated to each residence. If you went past that first tier of allocated water, then you were charged more for the additional water used.

The tiered program is the only incentive most water districts around the United States use to encourage residences to save water through punishment rather than reward. This program also made me something of a commodity even though my stay was only temporary. I was another body to add to the water equations, so I was welcomed with open arms, and I was happy to assist my friends.

Maria was frustrated to let her front lawn die and have weeds in the backyard due to dry and inhospitable desert soil. She would reminisce over how well they maintained their yards and the different plants they would grow. In the years I have known her, she has kept her house immaculate both inside and out. She loved to cook and would clean the dishes as soon as she used them. Now, she was worried about using too much water to do these tasks just to keep her standard of cleanliness and order.

She would point out the homes that also let their front lawns die and wondered how the homes with lush landscapes not far from them were able to afford the cost of water. Were they spending less water inside the home to maintain a perfect lawn? If so,

how clean was their house? These were the questions she would share with me, hoping I had some idea of the answer. The scarcity and the increased cost of water created a psychological trauma that I was not expecting to witness. Her comments were also in contrast to what Chef Ramsey shared. As someone in the wine industry, he stated he used less water in his home than in the restaurant.

Although Maria did comment that her power bill has not really changed, I would observe how she would be mindful of what appliances were running, like lights on or long oven bakes, which can cause the A/C to run longer. I assumed Maria's response came from years of conditioning spurred by the energy-saving propaganda of our youth due to the 1970s oil crisis. As a reprieve to her frugal living, Maria was grateful when friends invited her to wine country to enjoy a glass of wine, the beautiful gardens, and the music. Yet, sometimes she would feel a little resentment that the wineries can keep such a beautiful lawn while hers looks dried and withered. Always the optimist, she quickly shakes off the thought and enjoys dancing to the music. In this way, the wineries release the anxiety over the cost of water and aesthetics at home, because they feel someone else is paying for the water and energy.

She was not the only one with the same thoughts over how the wineries were managing resources. Someone with a supportive role in the wine industry encouraged me to go to a water district meeting with her. The meeting was aimed at the residents, and she thought I would be interested to know what residents are facing. Even she had questions about how wineries could keep nice lawns despite her role in promoting Wine Country and wondered how having three people from the wine industry on the water board might influence water distribution decisions. Attendees echoed these concerns. They

were pointing fingers at the wine industry people on the board to suggest they are benefiting from the position, yet ignoring those board members in housing development.

As Simms (2013) calculated, residents use more than vineyards and even wine production. However, the residents were not worried about the vineyards and tasting rooms. They were concerned with the tourist and wedding complexes that are becoming part of Wine Country, which include hotels, restaurants, halls, and stages to lure more people to the valley. They are aware that one of the board members, Bill Wilson, is interested in making the Valley the Disneyland of wine tourism, but at what cost to residents outside the valley?

These concerns inspired me to make my calculations based on publicly available numbers since the wineries were not willing to share their metrics. The argument the wine industry uses is that grapes use 1/3 gallon of water, so it is a better alternative than almond milk or even housing. There are several infographics to demonstrate the water use of almost every California produce. What wineries do not share with consumers is that it takes an average of 400-800 grapes (about 1 to 1.5 kg) to make a bottle of wine. This number varies depending on the grape varietal and viticultural practice, like row spacing and irrigation. Therefore, a bottle of wine could use a minimum of 150 gallons of water per bottle in just grapes alone.

The average bottle of wine is 750mL or about 25 fluid ounces. There are about 133 fluid ounces in a gallon or 5.32 bottles of wine. For winemaking and bottling, Simms (2013, 167-168) calculated 2.7 gallons of water were used per gallon of wine at this research site but cites that the standard amount is six gallons of water (Franson 2008). Using an average between Simms calculations and the standard amount, winemaking

and bottling could use about 23 gallons of water. Using one mid-range winery with a tourist complex from the valley as an example, the winery produces 25,000 cases of wine a year with one case containing 12 bottles, which means 300,000 bottles of wine. Using an average 600 grapes (200 gallons of water) per bottle plus the water used for winemaking and bottling of 23 gallons would mean that this winery moves 66.9 million gallons of water a year within and outside their wineries, and this is before calculating the water used in a tourist complex. If a hotel uses 100 - 200 gallons of water a day per occupied guest room, then this humble mid-range winery's hotel is using 36,500 to 73,000 gallons of water per year with just one room. In wine industry terms, it costs them 300 - 600 grapes, or one bottle of wine per room, per day.

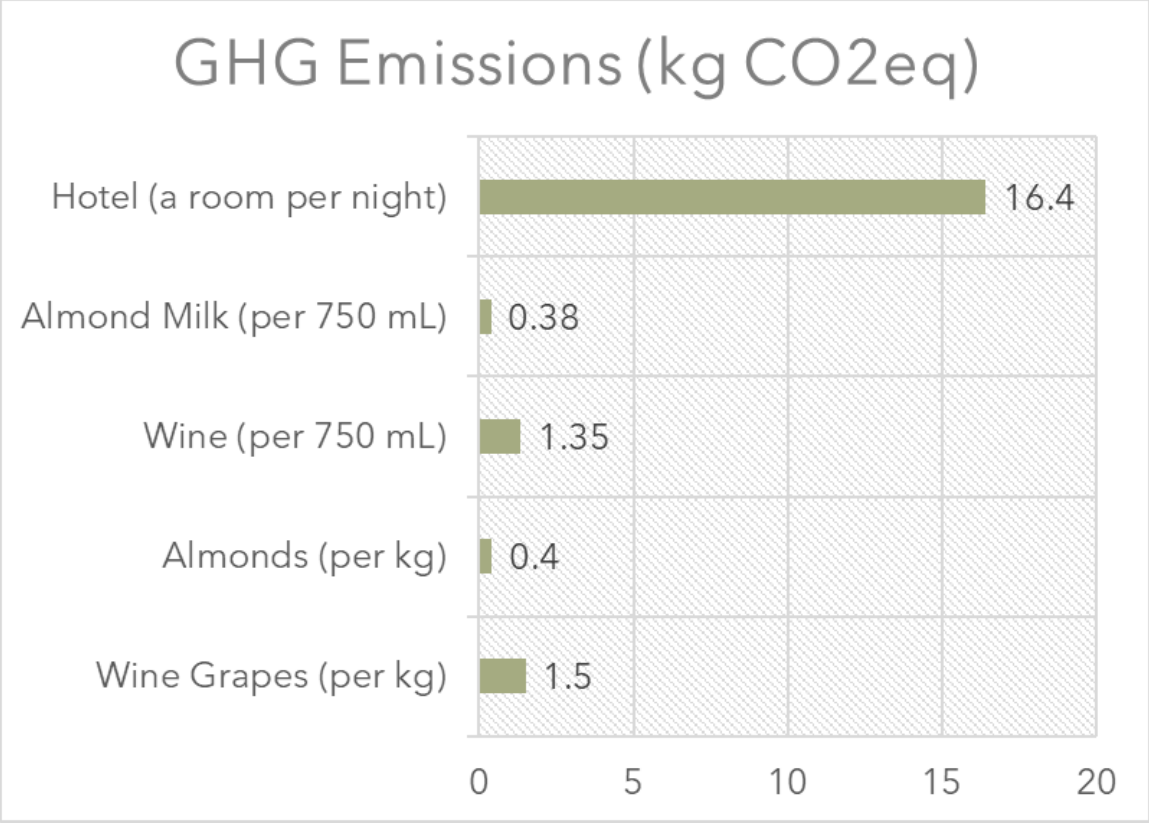

Figure 15. Carbon footprint comparison. Image by author generated from data sources: Poore and Nemecek (2018) and Winans et al. (2020)

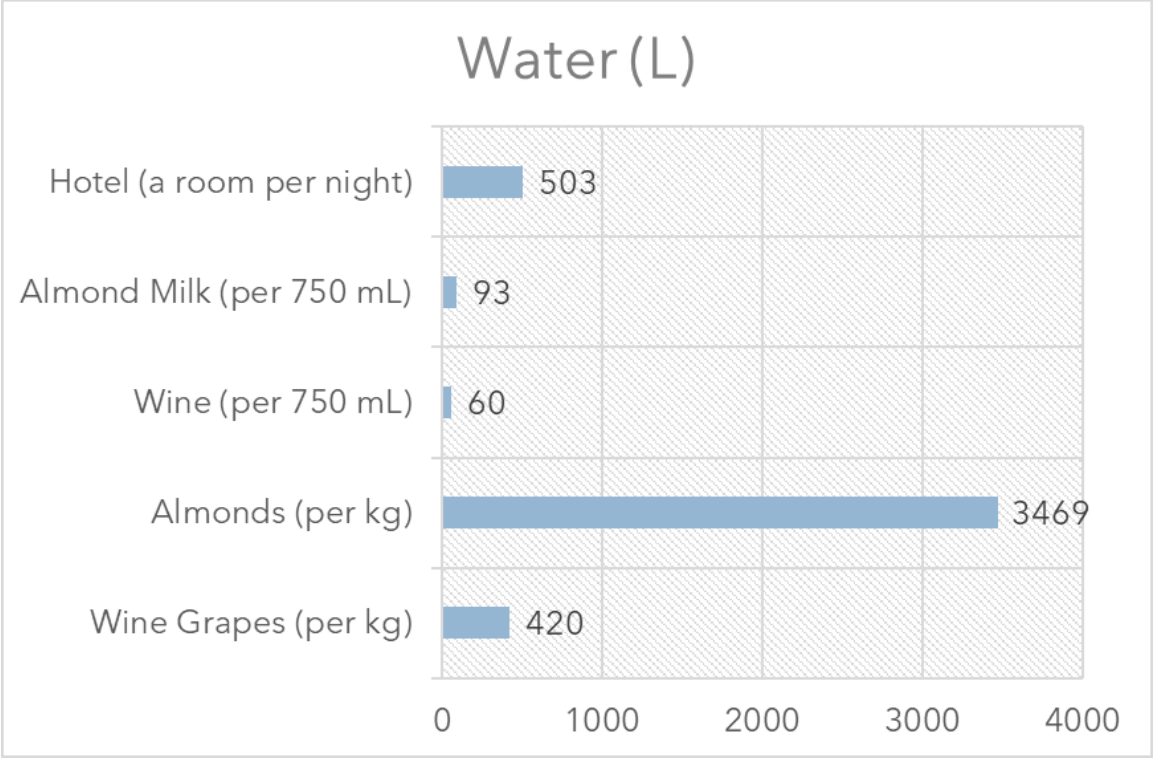

Figure 16. Water footprint comparison. Image by author generated from data sources: Poore and Nemecek (2018) and Winans et al. (2020)

These are the type of numbers people wanted to learn about in that water district meeting. However, water district representatives shifted the focus to housing development's use of water, which implied that the residents were a more significant threat than wine tourism development. The water district representatives also reinforced how grapes need less water than housing, and agriculture is in a different price tier. This water meeting was taking place in the Water District's downtown office, while outside the building, the town was ripping up its landscape to conserve water to comply with Executive Order B-29-15. The right-of-way beautification was never brought up in the meeting. However, since the commercial portion of the Wine Tourism Complex is tiered at a higher rate, then it is in the best interest of the Water District to have more commercial meters in an agricultural district.

Collecting and Accessing Nexus Metrics

> [Temecula is] the biggest area here in southern California for people to come out and visit who haven't seen the winery or haven't tasted wine. They love coming out here and seeing the vineyards and tasting the wine. So tourist is always [number] one and [number] two with a, with the vineyards. (Jackie Chan, Vineyard Manager)

Participants sent a mixed message on the metrics they were collecting for their wineries. Robert DeNiro could tell me sales are down based on the weather, which suggests they kept weather data along with their sales data. Moreover, it was understandable. The larger the complex, the easier it is to have expenses go out of control and lose profit without a well-orchestrated team, so one would think there would be more resource data collection, yet I felt the opposite was true. For example, their Facilities Manager said wine production uses the most water, yet that area of the facility was not metered separately to record those numbers. The rough calculations I provided above did not consider the restaurant and tasting rooms. However, it is fair to say that for every bottle of wine, the winery paid at least another bottle of wine, or more, for tourism in just water alone.

The most elusive stakeholder was hotel management, which I failed to recruit to add their perspective on the drought and tourism development and cover every scale of the wine tourism industry. The only success I had was interviewing a couple of chefs and one facility manager, plus several casual conversations with people that support the

hospitality industry, like servers. Aside from these interviews and conversations, my observations were based on my experience as a tourist. I studied the websites of wineries to see if they promote environmentally sustainable. Since there are primarily two meters, commercial and agriculture, Wine Tourism Complexes cannot differentiate the use of water between a hotel, restaurant, or barrel room, which would all be metered under the commercial water use, unless they had a separate meter. In speaking to these individuals in the hospitality business, I did not get the impression they were separately metered unless the facility was constructed apart from the main winery, for example, across the street from the primary water connection, which would require a separate meter. Even the Vineyard Manager quoted above understood, the tourism sector is the primary focus, which drives production. He figured more tourists, more vineyards, more work for him. Winemakers felt the same way. More tourists, more wine, more work for them. Yet, they failed to see how they were competing for resources and would blame one another for any perceived scarcity.

I also suspect that if they were keeping metrics, or quantified data, that they would keep this hidden to some degree from certain people, like me, the unofficial water police. California Water Resources Control Board (State Water Board 2020, accessed in 2015) expects for water districts to communicate use to the State as well as among its clients. State Water Board also listed the protocol to irrigating landscape. These prohibited decorative water features that do not recirculate water, prohibited restaurants from serving guest water automatically, and hotels were required to prominently display to guests the option not to launder linens daily. Hospitality businesses were also encouraged to upgrade their water appliances, like toilets and faucets. Some stakeholders were

concerned that tourists would come to Temecula to enjoy longer showers that they could not afford to do at home, thereby shifting the burden of water conservation from residents to the hospitality business. The hospitality business would affect the tiered rate that the commercial portion of the winery would pay. However, Diane Vondrasek (2015) explains, "While water costs are typically a smaller proportion of a hotel's utility line-item expense than energy costs, the potential for perpetually increasing water rates still can affect hotel [profit and loss] performance."

During my stay at hotels around Temecula, and while dining in Temecula Valley, there were few instances where businesses communicated water-saving measures. Newer hotels would automatically have efficient water appliances. In addition, there were tensions between small winery stakeholders and those with the money to invest in an expensive Wine Tourism Complex. With limited resources, like water, a few of the stakeholders were concerned they would pay more on land, grapes, and water because the larger wineries would take a larger share. In fact, at the beginning of my research study, just as the Executive Order was active, many stakeholders believed that they needed to use as much water as possible. They wanted to demonstrate to the RCWD that their facilities required a larger allotment of water, despite the RCWD explaining that that is not how it works. Rancho California Water District intentionally used metrics from historical data based on the square foot of use to stop Temecula Valley from this "use it or lose it" behavior.

Chapter Summary

This chapter of my dissertation reflects the most considerable challenges to collecting data. I had limited to no access to the hospitality sector, the focus was heavily on water, and there were contradictions as to what quantified data was collected. There was the least level of transparency. If there is a divide between Winemakers and Vineyard Manager, then I would say there is greater tension between the Wine Tourism Complex and those people in charge of making wine. This tension may be hidden or ignored since the tourism industry creates a demand for increased production. Also, in this portion of the Vinisocial Cycle, stakeholders steer away from emotional connections to “nature” and focus more on the economic aspects. However, they still seem to feel their way through resource management because few stakeholders have access to quantified data that could help reinforce or improve best management practices.

Chapter Seven

Discussion and Conclusion

This study aimed to understand the interrelationship between food, energy, and water among people who work in the wine and wine tourism industry in Temecula Valley. Decision- and policy-makers are requesting for social aspects to FEW nexus, and this study demonstrates the challenges to incorporating ethnography into FEW nexus assessments used for decision-making. I used a political ecology approach to study how different stakeholders at various scales perceive and construct interpretations of their relationships with multiple resources (e.g., Rodríguez-Labajos and Martínez-Alier 2015). Political ecology allows for the inclusion of non-human agency and how people perceive resources, sometimes at an emotional level. I use the term nature as the physical environment, which includes the organic and non-organic in various forms. This study demonstrates how certain nexus assessment models, especially LCA, expose "hot spots" for improvements to mitigate environmental impacts. Also, the literature review about these nexus models expose inconsistencies in data that cannot be easily explained without including the people making decisions about production, or performing the task.

Political ecology is often critiqued for not including enough of the environment in their ecological approach, but rather focuses on actors dealing with environmental issues, like an event (Vayda and Walters 1999). For this study, the drought was the environmental issue that greatly influenced stakeholder response, and could be considered "the event."

Depending on the stakeholder's perspective, they were awaiting El Niño as either a guest of honor or an unwanted visitor. When El Niño in 2015-2016 failed to bring relief from the drought, the stakeholders continued to concentrate on their relationship with wine and growing their wine industry, despite the threat of greater reductions to water allocations. Stakeholders were willing to pay more money on water and energy (to run water-saving equipment) to build their wine and wine tourism industry. This example demonstrates why event ecology does not fit this study. Who decides what is an event and when the event starts and ends? Technically, the drought began in 2011, but it was the stricter water reductions in 2015 that caused the greatest tensions throughout the state. If I focused on bigger things, like the drought or the arrival of El Niño, I would have missed how interactions with the smallest parts of nature contributed to how people managed resources.

The Vinisocial Cycle aided how I managed collecting ethnographies at various scales and locations through following the flow of wine. By viewing nature as an actor, rather than an object, I was able to witness how people interacted with organic forms, like grapevines, yeast, and soil microbes. Stakeholders' relationship with nature influenced how people perceived and managed other resources, or other parts of nature, like water and energy. Among human stakeholders, these relationships gravitated between two trains of thought: technology-centered and nature-centered. Often these sides correlated with ethnicity, but not exclusively. Non-Hispanic white stakeholders relied on technology more often than Hispanics, including incorporating the use of more water-saving techniques and considering mechanized harvesters as a means of control. Control over the limited water allocations and control over "unruly" laborers. Hispanics relied more on

nature, like using more water to ensure cleanliness and keeping rows clean so weeds do not rob nutrients from grapevines. The stakeholders that embraced both sides viewed themselves as actors that are part of nature trying to encourage collaboration with nature. Ulin (2013) states that terroir is used to naturalize agricultural products and this concept is reinforced by anthropologists that anthropomorphize nature. This study offers a different perspective where stakeholders' roles with a "natural" agricultural product affect discernment of relationships, based on their role in the industry, their ethnicity, and their perceptions of their existence with nature. So how can these relationships contribute to nexus metric assessments?

My inspirations for this research came from working in a transdisciplinary team with engineers. They would ask the anthropologists in the group, "how can we encourage people to choose to use it?" referring to convincing people to adopt engineered solutions to improve environmental sustainability. The real question is what makes people's access to resources and ability to make decisions about them, including using engineered solutions. Resource access depends on scale and power relations (Paulson, Gezon, and Watts 2003). At the valley-level, Winery Owners and Domestic Vineyard Owners controlled access to resources, how resource use was documented, and the use of technology to manage resources. Other actors expressed a desire to improve resource management and offered ideas about implementing engineered solutions, or removing them, to meet the winery production goals. The greatest challenge was access to the wine industry's nexus metrics, partly because those in lower management positions did not want to know or did not have the power to ask. While those with greater power, like Winery Owners, were concerned that they may be punished or judged for their resource

management, or business practices. Professionals in other disciplines are demanding social aspects for FEW nexus metrics, but those social aspects may directly limit access to quantitative and qualitative data.

If the data were available, which nexus assessment, or model, would best accommodate qualitative data? The two most common forms of nexus metric used for sustainability are LCA and SD modeling. Life Cycle Assessments (LCA) focus on quantified data and struggle to include the complexity of labor. In contract, Systems Dynamic (SD) modeling seems a promising solution because it can consider human's emotional responses to an event, but it can also be dangerously reductionist if not administered correctly. Even if an SD model can provide sound guidance to decision-and policy-makers, the data would have to be continually updated. Culture is not static, and people can be quite innovative when facing an environmental crisis, like a drought. Anthropology can provide some guidance, however there is little research into the anthropology of the FEW nexus, although information exists for individual resources. Anthropology can contribute significantly to this demand for qualitative data if we can figure out how to use ethnographies with other disciplines. Maybe SD modeling is a solution if used in transdisciplinary research, so not one discipline has the burden to wear so many hats. Nevertheless, an SD model requires ethnographic data, and this is my contribution.

The main focus of this dissertation is on the question, "What is the interrelationship between food, energy, and water among people who work in the wine and wine tourism industry in Temecula Valley?" I demonstrated how people with different ethnic backgrounds and positions in the wine industry respond to non-human agencies,

specifically grapevines, drought, and El Niño. Resistance seemed to be the central theme among most stakeholders and even non-human agents (e.g., El Niño never came). The Vinisocial Cycle method allowed for this act of resistance to come through in all areas and with different resources. The Vinisocial Cycle helps map the system of study and uses wine as a vehicle of transport through the cycle. Following the flow of wine allows the researcher to observe when resources are intersecting the path of the cycle. The cycle helped manage the observation of several resources (food, land, energy, and water) and production methods that use these resources within a system (e.g., vineyard management, winemaking, tourist experience-making). Power relations and the reason for stakeholder nonconformity were revealed by witnessing stakeholders' engagement in these interrelationships. For example, how labor (energy) decides when to irrigate (water) vineyards based on the message the vine is sending with its drooping leaves (sun-energy's effect) of grapevines (food) when water allocation for the week has been used, or despite orders to water less (policy). Resistance to industry policies at the winery- or vineyard-level that dictate resource management were performed as a means to exercise their limited power over resource management to improve the industry, based on their knowledge. Chris and Burritt (2013) could not understand why there was such variation in LCA results among wineries in Australia and suspected there were social aspects that were not taken into consideration. The Vinisocial Cycle helps explain some of the reasons for variation and this method can be used to collect data to supplement nexus metric modeling.

The Vinisocial Cycle also revealed how stakeholders view wine as food. Stakeholders struggled with their relationship with this substance. Is it food? Does it

provide nutrients? Nutritional labels are not required on alcoholic beverages because wine falls under the supervision of the Alcohol and Tobacco Tax and Trade Bureau, rather than the US Department of Agriculture. The government's resistance to recognize wine as food causes tensions with other agricultural products produced in the area. In the valley, most stakeholders agreed it was food, but not without mulling over their answer. What was surprising is how chefs did not consider it food, but something that complements food. These answers may have come from semantics, and require further study. Should I have referred to wine as a drink? More than likely it is our history with alcohol in general (Pinney 2007). Nexus metric modeling needs to incorporate this history and how it affects people's behavior to resource management of wine.

As for energy, Temecula Valley does not recognize the importance of their labor force, especially in the vineyard. Other stakeholders may misunderstand or misinterpret resistance by laborers. People who worked outdoors witnessed firsthand how living and non-living resources were affected by a lack of rain, and how that impacts their livelihood. As a result, some stakeholders would tend to vineyards in such a way to save their energy or increase grape production and quality. They made these decisions based on their connection with the vineyard rather than trust engineered solutions or academic information. These different perceptions were often split between perceptions by workers with Hispanics and Non-Hispanic whites. However, all stakeholders were using their "situated knowledge" (Haraway 1988), or their worldview, to exercise and gain power more than increase their economic standing. As Foucault (1987, 170) states, these power relations

> “consists of using this resistance as a chemical catalyst so as to bring to light power relations, locate their position, and find out their point of application and the methods used. Rather than analyzing power from the point of view of its internal rationality, it consists of analyzing power relations through the antagonism of strategies.”

Perceptions and connections shifted as I moved from the field to indoors to the wineries and wine tourism complex. In the winery, the connection was with wine as a living substance full of yeasts that have to be either nurtured or killed to produce the best-tasting wine. While on the surface, these actions may seem to appropriate nature, I would argue they were negotiations because recipes could not guarantee results. The flavor of wine changes from year to year, depending on environmental factors and wine’s relationship with winemakers. In addition, views of energy differed among ethnic divides, with winemakers of Hispanic ethnicity opting for human energy – laborers - rather than convert to sometimes expensive engineered solutions, such as mechanical harvesting. They make this decision not only because these changes affect the fruit (mechanical harvesting damaging fruit), but also because they understand the impact the switch will make to their ethnic community. Unfortunately, some engineered solutions cause stakeholders to save on one resource at the expense of another. Each stakeholder negotiated the trade-offs based on their “situated” and “expert” knowledge.

Finally, the most significant resistance came from stakeholders collecting or sharing metric data. Not collecting data seems counter-intuitive from a business and economic standpoint since it would be challenging to judge return on investment (ROI),

or economic success, without numbers. Quantified assessments are essential to provide a roadmap to sustainable development. However, it cannot calculate or predict human response, at least not without the help of ethnographic data that can provide this context in order to overcome these challenges. Resistance may seem futile, but it is very human. It is how we exercise our power.

Conclusion

Robbins (2012) states that there are five themes in political ecology: (1) environmental degradation and marginalization, (2) conservation and control, (3) environmental conflict, (4) environmental subjects and identities, and (5) political objects and actors. Whether Temecula Valley is suffering from environmental degradation may be debatable. This debate on the degradation of the Western lands is demonstrated in Sheridan (2007) where he discusses tensions between environmentalists and ranchers over the use of public lands. Drought is a part of life in California, yet its thirst for water is affecting other states (Arax 2019). In contrast, California produces the cleanest electricity in the nation (U.S. Environmental Protection Agency 2020).

In the wine industry, environmental degradation and marginalization occurs with transforming a valley into a monocultural agricultural product. The industry believes removing citrus and other agricultural industries may provide protection from Pierce's disease and build the Wine Country brand. However, depending on one crop can make them vulnerable when weather events or poor management decisions occur, like re-using untreated wine waste in the vineyard that can spread mealybugs and disease. Available

land in the valley that was once left fallow is slowly being transformed into wine tourism complexes that demand more water and energy than a simple vineyard.

Key stakeholders in Temecula Valley want to conserve and control their brand in the wine industry, however sometimes at the cost of water and labor. The industry is willing to adopt some water or energy-saving engineered solutions, and disregard others due to individual's perception of aesthetics or achieving greater wine quality. They resist some government mandates or academic knowledge sometimes arguing that it doesn't fit with their valley. Domestic vineyard owners were more involved with cost of production since they had to determine if investing land, water and money in vineyard management was worth the return. However, they also relied on vineyard managers and others in the wine industry to guide them. As the unit of production becomes larger, stakeholders may have control to conserve resources within their own role, but not provided with all the information (big picture) they need to carry this out efficiently. In medium and large wineries, winery owners may collect nexus metrics but not share the numbers with stakeholders that can actively participate in conservation of resources.

Unfortunately, Temecula Valley created its own environmental conflict when they adopted the Wine Country Community Plan, which encouraged the valley to grow to more than 100 wineries in a very short time (Yelvington, Dillon-Sumner, and Simms 2014). This plan was created with little environmental assessment to consider the long-term effects on the economy. The plan was approved in 2014 before the drought extended for a longer period of time. By the time I interviewed people in 2016, stakeholders were concerned that outside investors were able to purchase more land and build larger tourism complexes, which may cause a conflict with wine grape varietal and water availability.

Tourism complexes were built near the road, which are also prime arable land to plant vineyards. Also, people were concerned with the traffic congestion that would occur with a large increase in tourists, which adds more complexity to an LCA.

For this study, food, energy, and water were the environmental subjects, because they are the resources being managed and that influenced stakeholder identities. Increasing demand of food affects the quantity and type of water and energy used. With global population and resource use increasing, the concern of policy-makers is how to have enough for everyone without increasing the negative effects that contribute to climate change. However, the political object of this study was how resources are assessed and how data was collected and used by various actors, wine industry stakeholders and people administering the assessments. As I argued for this dissertation, environmental subjects and actors may shift positions, if non-human agency was considered in a study. Stakeholders responded to grapevines and El Niño like they had their own agency. Stakeholders had control over grapevines yet their response was to accommodate the grapevine, which makes me question who has the control. The same was true with El Niño, a weather event they have no control over yet influences resource management decisions.

As for the assessments, like LCA and SD, there are several issues that were discussed in this dissertation. There is not enough qualitative and quantitative data on wine grape production, winemaking and much less wine tourism to generate assessments. Also, the social aspects are largely disregarded, especially on labor-intensive sections of the wine industry, like vineyards and hospitality. Stakeholders may also disregard the social aspects in favor of quantified data as a means to reduce the

value of labor and justify inequity in resource management. However, Life Cycle Assessments are codified and easier to operationalize in an industry if there is enough quantified data despite its limits of excluding social aspects. Rebs, Brandenburg, and Seuring (2019) suggest a hybrid that combines LCA and SD to tap into the strength of both assessments. The results of the hybrid would be better accepted by the community because it will be centered on knowledge and metrics of Temecula Valley and not Napa or any other wine region. This hybrid would include the community thereby representing Temecula Valley's physical and constructed terroir. Rodríguez-Labajos and Martínez-Alier (2015, 552) discuss solutions to water conflicts, which encourages how these types of "bottom–up initiatives can express ecological, livelihood and cultural values that are alien to markets or to state power."

Dissemination

The results of this study will be shared with Temecula Valley in at least two ways. A copy of my dissertation will be provided to the Ronald H. Roberts Temecula Public Library, which curates other ethnographies and ethnographic material on Temecula Valley's wine industry. Also, I will present my results at the Grape Day 2021 conference that takes place in April; however, this would depend on how Temecula Valley has shifted the execution of this event in response to the Covid-19 pandemic. I hope to start a conversation with the community about what nexus metrics are collected and shared. This conversation would have to include engineers familiar with transdisciplinary and community-based research. This conversation may not take place during the conference but may provide opportunities afterward for follow-up. There was more excitement for

stakeholders to participate in interviews after I first presented my research proposal in 2016 and perhaps this would generate a similar response.

Applied Implications

The goal for this dissertation was to provide qualitative data for the FEW nexus, but also explain the challenges to integrating social aspects, including how anthropologists are trained to work in transdisciplinary projects. Stakeholders have individual definitions of terroir and sustainability, and different power dynamics to result in variations in quantified data, the adoption of engineered solutions, and the politics of collecting and sharing nexus metrics. Systems Dynamic modeling seems like a promising solution that integrates quantified and qualitative data. There was only one SD model conducted on the wine industry by sociologists (Givens et al. 2018) to understand resilience with the knowledge that this is not the most equitable approach. Resilience for whom? However, this modeling seems to be the most promising as long as it is transdisciplinary, rather than taking the polymath approach that Sterman suggests.

Which leads to the next challenge: how are anthropologists trained for FEW nexus research? First, there is the issue of communication. During my time in the NSF PIRE project at USF, engineers, marine biologists, and anthropologists all had to learn each other's language and find ways to compromise how things are measured in one discipline compared to another. For example, engineers took ahistorical and positivism approaches, which would provide rapid results. Anthropologists take slow, methodical, and critical approaches to ensure there are equitable, culturally-relevant solutions. However, the slow methodology proved to be a problem with making a difference in FEW nexus research.

One solution is to actively teach students rapid ethnographic methods that would also make them employable outside of academia.

Another key concern is maintaining respect between disciplines, while yet breaking down silos. I identify as a Renaissance Woman since I have had a variety of jobs and experiences, however, I am an expert of few. So, I understand firsthand how SD modeling can be limiting. As a former businesswoman in the construction industry, I could not call myself an engineer since I lacked the formal training even though I could conduct some of the load calculations needed to make the buildings I design from falling. I also was not an architect. I was a draftsperson who needed to learn several skills, yet depended on these professionals, which I had high respect for, to validate my work. At the same time, my clients would search for the paper on the wall that would supposedly reflect my ability. Now I have several papers to place on a wall that reflects my specialized “expert” knowledge. I even had the opportunity to conduct an LCA for this research, but going through that exercise would only help me understand the assessment and the struggle of the engineer rather than be the engineer. Another issue identified by those of us that have drunk the transdisciplinary Kool-aid is the lack of funding to support transdisciplinary research. Nevertheless, when I conduct this type of research again, I would take a transdisciplinary approach that includes several experts. In addition, I would include the community to help guide solutions through community-based participatory research (CBPR), so there is equal representation of situated and expert knowledge.

Since CBPR was not part of this research, I am tasked to come up with suggestions that could be applied to this situation in Temecula Valley. Even if this data was collected accurately and without bias, it has a specific shelf life. If I collected quantitative data along

with my qualitative data, both would reflect a moment in time when a drought ordinance was in place, electricity and natural gas were still affordable, and the economy was becoming stronger to support agritourism of a luxury good. I write this in 2020. Who knows what the future, let alone the rest of the year, holds?

As I am writing, the country is dealing with a pandemic (Covid-19) that has hit the agriculture and hospitality sector the hardest just as Temecula Valley decided to invest in their tourism – bottle per bottle. Temecula Valley could use this present crisis to consider their resiliency in the wine and wine tourism industry. Instead of the next Disneyland, maybe become an Epcot, which is known for its educational themes and focus on sustainability. Why not provide a complete experience of Temecula's terroir? Steenberg et al's (2015) LCA could be applied to Temecula Valley since their goal is to be the next Napa Valley. This means more vineyards, more labor, and even a happy existence with residences. In addition, Temecula Valley provides a relaxed, non-judging atmosphere to educate consumers about wine, so why not extend it to sustainability?

Steenberg and colleagues (2015) suggested that the wine industry should consider alternative high-value co-products to improve their environmental footprint. There are several things Temecula Valley could do to start shifting to sustainable wine tourism. An LCA and SD modeling hybrid can help create a strategic plan that most of the valley can get behind. Also, this plan can send a clear message to consumers that they are actively participating in the conservation of Temecula Valley Wine Country and those other artisanal and agricultural products that support the wine tourism industry. However, this would require policies for data collecting and sharing that are no different from those needed to use the Meritage name on wine. This effort would create the greatest source

of contention among wineries in Temecula Valley that compete to set themselves apart from other wineries in the valley, similar to what Sheridan (2007)witnessed with ranchers.

To summarize, the greatest challenges to integrating an ethnography of the Temecula Valley wine industry with FEW nexus research and decision-making are data and models. There is a lack of quantitative and some qualitative data in this valley. The work of the research by Kevin Yelvington and his students is remedying this situation and offer a benchmark for future research (Yelvington, Simms, and Murray 2012; Simms 2013; Dillon-Sumner 2014; Yelvington, Dillon-Sumner, and Simms 2014). Collecting quantitative data may be a little more challenging if stakeholders are concerned over being punished or judged for their resource management, or reveal winery secrets. This dissertation lays the groundwork for collecting multiple resource data on future studies in Temecula Valley or other wine regions. However, it requires input from the community and a transdisciplinary team of experts in nexus metric assessments to expand the scope of this study.

References

Adams, Damian C, Derek Allen, Tatiana Borisova, Diane E Boellstorff, Michael D Smolen, and Robert L Mahler. 2013. "The influence of water attitudes, perceptions, and learning preferences on water-conserving actions." *Natural Sciences Education* 42 (1): 114-122.

Adams, Richard Newbold. 1975. *Energy and structure: a theory of social power*. University of Texas Press.

AgroChart. 2016. Pt 1: Saudi Arabia ended its domestic wheat production program that lasted for more than three decades. *Global Grain*. Accessed June 15, 2020.

Allan, John A. 1998. "Virtual Water: A Strategic Resource; Global Solutions to Regional Deficits." *Ground Water* 36 (4): 545-547.

---. 2003. "Virtual Water – the Water, Food, and Trade Nexus. Useful Concept or Misleading Metaphor?" *Water International* 28 (1): 106-113.

Anand, Nikhil. 2015. "Leaky States: Water Audits, Ignorance, and the Politics of Infrastructure." *Public Culture* 27 (2): 305-330.

Appadurai, Arjun, ed. 1986. *The Social Life of Things: Commodities in Cultural Perspective*. Cambridge: Cambridge University Press.

Arax, Mark. 2019. *The dreamt land: chasing water and dust across California*. Vintage.

Ashoori, Negin, David A. Dzombak, and Mitchell J. Small. 2016. "Modeling the Effects of Conservation, Demographics, Price, and Climate on Urban Water Demand in Los Angeles, California." *Water Resources Management* 30 (14): 5247-5262. https://doi.org/10.1007/s11269-016-1483-7. https://doi.org/10.1007/s11269-016-1483-7.

Associated Press. 2013. "Feds to Allow Nutrition Labels on Beer, Wine, and Spirit Bottles." Daily News. Accessed September 23, 2015. https://www.nydailynews.com/life-style/health/feds-nutrition-labels-beer-wine-spirit-bottles-article-1.1360649.

Aurier, Philippe, Fatiha Fort, and Lucie Sirieix. 2005. "Exploring terroir product meanings for the consumer." *Anthropology of food* (4).

Balakrishnan, Anita. 2015. "California Wine: Grapes are Drought-Tolerant, Not Invincible." Business. NBC News. Accessed August 1, 2015. http://www.nbcnews.com/storyline/california-drought/california-wine-grapes-are-drought-tolerant-not-invincible-n334721.

Balée, William. 2006. "The research program of historical ecology." *Annu. Rev. Anthropol.* 35: 75-98.

Bateson, Gregory. 1991. *A Sacred Unity: Further Steps to an Ecology of Mind*. New York: A Cornelia & Michael Bessie Book.

Bazilian, Morgan, Holger Rogner, Mark Howels, Sebastian Hermann, Douglas Arent, Dolf Gielen, Pasquale Steduto, Alexander Mueller, Paul Komor, Richard S.J. Tol, and Kandeh K. Yumkella. 2011. "Considering the Energy, Water, and Food Nexus: Towards an Integrated Modeling Approach." *Energy Policy* 39: 7896-7906.

Bear, Christopher, and Jacob Bull. 2011. "Water Matters: Agency, Flows, and Frictions." *Environment and Planning A* 43: 2261-2266.

Biersack, Aletta. 2006. "Reimagining political ecology: culture/power/history/nature." In *Reimagining political ecology*, edited by Aletta Biersack and James B Greenberg, 3-40. Duke University Press.

Black, Rachel E., and Robert C. Ulin, eds. 2013. *Wine and Culture: Vineyard to Glass*. London: Bloomsbury.

Blaikie, Piers, and Harold Brookfield. 1987. *Land Degradation and Society*. London: Metheun and Co. Ltd.

Bradshaw, Michael, and Hayley Leck. 2014. "A Nexus Approach to Global Challenges." The Guardian. Last Modified June 13, 2014. www.theguardian.com/science/political-science/2014/jun/13/nexus-global-challenges-food-energy-water.

Bryant, Raymond L, and Sinead Bailey. 1997. *Third World Political Ecology*. New York: Routledge.

Budds, Jessica. 2009. "Contested H2O: Science, Policy and Politics in Water Resources Management in Chile." *Geoforum* 40 (3): 418-430.

Bull, Jacob. 2009. "Watery masculinities: fly-fishing and the angling male in the South West of England." *Gender, Place and Culture* 16 (4): 445-465.

California Department of Water Resources. 2019. "Home." Accessed December 15, 2019. https://water.ca.gov/.

Calwineries. 2020. "Pierces Disease." Accessed April 15, 2020. http://calwineries.com/learn/grape-growing/pests-and-diseases/pierces-disease.

Castree, Noel, and Derek Gregory, eds. 2006. *David Harvey: A Critical Reader*, *Progress in Human Geography*: Blackwell Publishing.

Census, U.S. 2019. "Census.gov." United States Census Bureau. Accessed July 17, 2019. https://www.census.gov/.

Chapman, Chelsea. 2013. "Multinatural resources: ontologies of energy and the politics of inevitability in Alaska." In *Cultures of Energy: Power, Practices, Technologies*, edited by S. Strauss, S. Rupp and T. Love, 96-109. Walnut Creek, California: Left Coast Press.

Christ, Katherine L., and Roger L. Burritt. 2013. "Critical environmental concerns in wine production: an integrative review." *Journal of Cleaner Production* 53 (2013): 232-242. https://doi.org/https://doi.org/10.1016/j.jclepro.2013.04.007.

Clastres, P. 1987. *Society Against the State*. Translated by Robert Hurley and Abe Stein. New York: Zone Books.

Cockburn, A, and James Ridgeway, eds. 1979. *Political Ecology: An Activist's Reader on Energy, Land*, *Food, Technology, Health, and the Economics and Politics of Social Change*.

Coe, Sophie D., and Michael D. Coe. 1996. *The true history of chocolate*. Thames and Hudson.

Colman, Tyler. 2008. *Wine politics: How governments, environmentalists, mobsters, and critics influence the wines we drink*. Univ of California Press.

Copeland, Claudia. 2010. *Terrorism and Security Issues Facing the Water Infrastructure Sector. .* Congressional Research Service, Library of Congress (Washington, DC).

Cornejo, PK, MVE Santana, DR Hokanson, JR Mihelcic, and Q Zhang. 2014. "Carbon footprint of water reuse and desalination: a review of greenhouse gas emissions and estimation tools." *Journal of Water Reuse and Desalination* 4 (4): 238-252.

Cronon, William. 1995. "Introduction." In *Uncommon Ground: Toward Reinventing Nature*, edited by William Cronon. New York: WW Norton & Company.

Curran, Mary Ann. 2017. "Overview of Goal and Scope Definition in Life Cycle Assessment." In *Goal and Scope Definition in Life Cycle Assessment*, edited by M.A. Curran, In LCA Compendium – The Complete World of Life Cycle Assessment, 1-62. Dordrecht, Netherlands: Springer.

Dale, Alexander T. 2013. "The Sustainable Water-Energy Nexus: Life-cycle Impacts and Feasibility of Regional Energy and Water Supply Scenarios." Ph.D. dissertation, University of Pittsburgh.

Daynes, Sarah. 2013. "The social life of terroir among Bordeaux winemakers." In *Wine and Culture: Vineyard to Glass*, edited by Rachel E. Black and Robert C. Ulin, 15-32. London: Bloomsbury.

Degani, Michael. 2013. "Emergency Power: Time, Ethics, and Electricity in Postsocialist Tanzania." In *Cultures of Energy: Power, Practices, Technologies*, edited by Sarah Strauss, Stephanie Rupp and Thomas Love, 177-192. Walnut Creek: Left Coast Press.

Demossier, Marion. 2011. "Beyond terroir: territorial construction, hegemonic discourses, and French wine culture." *Journal of the Royal Anthropological Institute* 17 (4): 685-705.

Dennehy, Kevin. 2015. "The Other Side of Almonds: A Light Carbon Footprint." News. Yale School of the Environment. Accessed June 15, 2020. https://environment.yale.edu/news/article/the-other-side-of-almonds-a-light-carbon-footprint/.

Denzin, Norman K. 1978. *The Research Act: A Theoretical Introduction to Sociological Methods*. New York: McGraw-Hill.

Department of Energy, US. 2006. *Energy Demands on Water Resources: Report to Congress on the Interdependence of Energy and Water.* United States Department of Energy.

Department of Food and Agriculture, California. 2019. "California Agricultural Production Statistics." State of California. Accessed July 17,2019. https://www.cdfa.ca.gov/statistics/.

Dillon-Sumner, Laurel Dawn. 2014. "Cultivating Change: Negotiating Development and Public Policy in Southern California's Wine Country." Master's thesis, Department of Anthropology, University of South Florida.

Douglas, Mary. 2003. *Constructive Drinking: Perspectives on Drink from Anthropology*. London: Routledge.

Duffy, Eileen. 2009. "Is Wine Food?". Palate Press – The Online Wine Magazine. Last Modified September 18, 2009. Accessed September 22, 2015. http://palatepress.com/2009/09/wine/is-wine-food/.

Eden, Sally, and Christopher Bear. 2011. "Reading the River through 'Watercraft': Environmental Engagement through Knowledge and Practice in Freshwater Angling." *Cultural Geographies* 18 (3): 297-314.

Escobar, Arturo. 1999. "After Nature: Steps to an Antiessentialist Political Ecology." *Current Anthropology* 40 (1): 1-30.

Eubanks, Mary W. 2001. "An interdisciplinary perspective on the origin of maize." *Latin American Antiquity*: 91-98.

Executive Order B-29-15. April 1, 2015.

Ferrara, Carmen, and Giovanni De Feo. 2018. "Life cycle assessment application to the wine sector: a critical review." *Sustainability* 10 (2): 395.

Filimonau, Viachaslau, Janet Dickinson, Derek Robbins, and Mark AJ Huijbregts. 2011. "Reviewing the carbon footprint analysis of hotels: Life Cycle Energy Analysis (LCEA) as a holistic method for carbon impact appraisal of tourist accommodation." *Journal of Cleaner Production* 19 (17-18): 1917-1930.

Forrester, Jay W. 1961. *Industrial Dynamics*. Waltham, MA: Pegasus Communications.

---. 1969. *Urban Dynamics*. Cambridge, Massachusetts: The M.I.T. Press.

---. 1995. "The beginning of system dynamics." *McKinsey Quarterly*, 4-17.

---. 2007. "System dynamics—the next fifty years." *System Dynamics Review* 23 (2-3): 359-370. https://doi.org/https://doi.org/10.1002/sdr.381. https://onlinelibrary.wiley.com/doi/abs/10.1002/sdr.381.

Foster, John Bellamy. 2000. *Marx's Ecology: Materialism and Nature*. New York: Monthly Review Press.

Fox, Justin. 2015. "Amid a Drought, Cue the Almond Shaming." Bloomberg Opinion. Last Modified April 7, 2015. Accessed August 1, 2015. http://www.bloombergview.com/articles/2015-04-07/california-s-almond-farmers-have-become-a-target.

Franson, Paul. 2008. "Water Use in the Winery." *Wine Business Monthly*. https://www.winebusiness.com/.

Ganbavale, Gouri. 2018. "Carbon Neutral Food Menu for Restaurants." Energy Policy and Climate, John Hopkins University.

Givens, Jennifer E., Julie Padowski, Rebecca Witinok-Huber, Barbara Cosens, Christian D. Guzman, Michael Briscoe, Keyvan Malek, Jan Boll, and Jennifer Adam. 2018. "Incorporating Social System Dynamics in the Columbia River Basin: Food-Energy-Water Resilience and Sustainability Modeling in the Yakima River Basin." *Frontiers in Environmental Science* 6 (104): 1-19. https://doi.org/https://doi.org/10.3389/fenvs.2018.00104.

Gleick, Peter H. 1992. "Environmental Consequences of Hydroelectric Development: The Role of Facility Size and Type." *Energy* 17 (8): 735-747.

---. 1994. "Water and Energy." *Annual Review of Energy and the Environment* 19 (1): 267-299.

Gouldner, Alvin Ward. 1973. *For Sociology: Renewal and Critique in Sociology Today*. London: Allen Lane.

Grafton, R Quentin, Long Chu, and Paul Wyrwoll. 2020. "The paradox of water pricing: dichotomies, dilemmas, and decisions." *Oxford Review of Economic Policy* 36 (1): 86-107. https://doi.org/10.1093/oxrep/grz030. https://doi.org/10.1093/oxrep/grz030.

Greenberg, James B., and Thomas K. Park. 1994. "Political Ecology." *Journal of Political Ecology* 1: 1-12.

Grigg, David. 2004. "Wine, spirits and beer: World patterns of consumption." *Geography*: 99-110.

Hackman, Rose. 2015. "Hottest trend in California? Try 'drought shaming' your water-wasting neighbors." Raw Story. Last Modified May 16, 2015. Accessed June 20, 2015. https://www.rawstory.com/2015/05/hottest-trend-in-california-try-drought-shaming-your-water-wasting-neighbors/.

Hamblin, James. 2014. "The Dark Side of Almond Use." The Atlantic. Last Modified August 28, 2014. Accessed August 1, 2015. http://www.theatlantic.com/health/archive/2014/08/almonds-demon-nuts/379244/.

Hammond, Debora. 1997. "Toward a Science of Synthesis: The Heritage of General Systems Theory." Ph.D. Dissertation, Department of History, University of California.

Harris, Marvin. 1978. "India's sacred cow." *Human Nature* 1 (2): 28-36.

Heims, Steve Joshua. 1991. Constructing a Social Science for Postwar America: The Cybernetics Group, 1946–1953. The M.I.T. Press.

Hempel, Lamont C. 1996. *Environmental Governance: The Global Challenge*. Washington, DC: Island Press.

Himmelgreen, David A, and Nancy Romero-Daza. 2010. "Eliminating "Hunger" in the US: Changes in policy regarding the measurement of food security." *Food and Foodways* 18 (1-2): 96-113.

Hoff, Holger. 2011. "Understanding the Nexus: Background Paper for the Bonn2011 Conference." Bonn2011 Conference: The Water, Energy and Food Security Nexus, Stockholm.

Hubble, Gavin. 2017. "Diurnal Temperature Variation." Wine Guy. Accessed June 15, 2020. http://www.wineguy.co.nz/index.php/81-all-about-wine/766-diurnal-variation.

Ingold, Tim. 1990. "An Anthropologist Looks at Biology." *Man*: 208-229.

International Trade Administration. 2011. *U.S. Wine Industry – 2011.*

Jensen, Allan Astrup, Leif Hoffman, BT Moller, Anders Schmidt, Kim Christiansen, John Elkington, and Franceska van Dijk. 1997. *Life Cycle Assessment (LCA): A Guide to Approaches, Experiences and Information Sources*. Vol. No. 6.*Environmental Issues Series*. Denmark: European Environment Agency.

Johnston, Barbara Rose. 1987. "The Political Ecology of Development: Changing Resource Relations and the Impacts of Tourism in St. Thomas, United States Virgin Islands." Ph.D. dissertation, Department of Anthropology, University of Massachusetts.

---. 1998. "Culture, Power and the Hydrological Cycle: Creating and Responding to Water Scarcity on St. Thomas, Virgin Islands." In *Water, Culture, and Power: Local Struggles in a Global Context*, edited by John M. Donahue and Barbara Rose Johnston, 285-312. Washington, D.C.: Island Press.

Jones, Andrew D, Lesli Hoey, Jennifer Blesh, Laura Miller, Ashley Green, and Lilly Fink Shapiro. 2016. "A systematic review of the measurement of sustainable diets." *Advances in nutrition* 7 (4): 641-664.

Jones, Gregory. 2015. "Terroir and the Importance of Climate to Winegrape Production." Climate, Grapes, and Wine. GuildSomm. https://www.guildsomm.com/public_content/features/articles/b/gregory_jones/posts/climate-grapes-and-wine.

Jones, Phil, and Neil Macdonald. 2007. "Making space for unruly water: Sustainable drainage systems and the disciplining of surface runoff." *Geoforum* 38 (3): 534-544.

Jugy, Camille, Leslie Jacquemin, Claire Villemur, Marion Delaire, and Sébastien Garnier. 2016. "Methodology for evaluating the sustainability of products and processes: application to alternative substitution techniques of chromium VI." *International Journal on Interactive Design and Manufacturing (IJIDeM)* 10 (3): 329-334.

Kane, Stephanie C., and Avi Brisman. 2014. "Water and Climate Change." *Anthropology News* 55 (7): 8-9.

Kenway, Steven J., P. A. Lant, A. Priestley, and Peter Daniels. 2011. "The Connection between Water and Energy in Cities: A Review." *Water Science and Technology* 63 (9): 1983-1990.

Kirksey, S Eben, and Stefan Helmreich. 2010. "The emergence of multispecies ethnography." *Cultural anthropology* 25 (4): 545-576.

Klein, Jakob A, and James L Watson. 2016. *The handbook of food and anthropology*. Bloomsbury Publishing.

Klöpffer, Walter. 2012. "The critical review of life cycle assessment studies according to ISO 14040 and 14044." *The International Journal of Life Cycle Assessment* 17 (9): 1087-1093.

Knaup, Marcela Beatriz. 2010. "An Overview of U.S. Wine Law." Avvo. Accessed September 23, 2015. http://www.avvo.com/legal-guides/ugc/an-overview-of-us-wine-law-1.

Kramer, Nic JTA, and Jacob de Smit. 1977. *Systems Thinking: Concepts and Notes*. Leiden, Netherlands: Martinus Nijhoff Social Sciences Division.

Kropotkin, Peter. 1888. *Mutual Aid: A Factor of Evolution*. Boston: Porter Sargent Publishers.

Lardie, Matt. 2020. "Three Ways to Calculate the Carbon Footprint of Your Wine." The Advocacy Issue. Wine Enthusiast. Accessed June 15, 2020. https://www.winemag.com/2020/02/25/wine-environment-carbon-footprint/.

Lawford, Richard, Janos Bogardi, Sina Marx, Sharad Jain, Claudia Pahl Wostl, Kathrin Knüppe, Claudia Ringler, Felino Lansigan, and Francisco Meza. 2013. "Basin Perspectives on the Water–Energy–Food Security Nexus." *Current Opinion in Environmental Sustainability* 5 (6): 607-616.

Linton, Jamie. 2007. "What is Water? The History and Crisis of a Modern Abstraction." Ph.D. dissertation, Department of Geography and Environmental Studies, Carleton University.

---. 2008. "Is the Hydrologic Cycle Sustainable? A Historical–Geographical Critique of a Modern Concept." *Annals of the Association of American Geographers* 98 (3): 630-649.

---. 2010. *What is Water?: The History of a Modern Abstraction*. Vancouver: UBC Press.

Linton, Jamie, and Jessica Budds. 2014. "The Hydrosocial Cycle: Defining and Mobilizing a Relational-Dialectical Approach to Water." *Geoforum* 57: 170-180.

Luby, Ian H, Stephen Polasky, and Deborah L Swackhamer. 2018. "US urban water prices: Cheaper when drier." *Water Resources Research* 54 (9): 6126-6132.

Lukacs, Paul. 2000. *American Vintage: The Rise of American Wine*. Boston: Houghton Mifflin.

MacNeil, Karen. 2015. *The Wine Bible*. Workman Publishing.

Maggioni, Elena. 2015. "Water demand management in times of drought: What matters for water conservation." *Water Resources Research* 51 (1): 125-139.

Marsh, Debborah Marie. 2008. "The Water-Energy Nexus: A Comprehensive Analysis in the Context of New South Wales." Ph.D. dissertation, Department of Engineering and Information Technologies, University of Technology.

Marx, Karl, and Fredrick Engels. 1970 [1846]. *The German Ideology, Part I*. Translated by CJ Arthur. New York: International.

Mathison, Sandra. 1988. "Why Triangulate?" *Educational Researcher* 17 (2): 13-17.

Mauss, Marcel. 1990. *The Gift: The Form and Reason for Exchange in Archaic Society*. London: Routledge.

Maynard, Lynnsay. 2014. "What Would Jesus Drink? A Class Exploring Ancient Wines Asks." Food for Thought. NPR. Accessed August 13, 2020. https://www.npr.org/sections/thesalt/2014/12/25/372727808/what-would-jesus-drink-a-class-exploring-ancient-wines-asks.

McAuliffe, Graham A, Taro Takahashi, and Michael RF Lee. 2020. "Applications of nutritional functional units in commodity-level life cycle assessment (LCA) of agri-food systems." *The International Journal of Life Cycle Assessment* 25 (2): 208-221.

McGee, William J. 1909. "Water as a Resource." *The Annals of the American Academy of Political and Social Science* 33 (3): 37-50.

McNeil, Cameron L. 2006. *Chocolate in Mesoamerica: a cultural history of cacao*. University Press of Florida Gainesville.

Mcneish, John-Andrew. 2006. "Stones on the Road: The Politics of Participation and the Generation of Crisis in Bolivia." *Bulletin of Latin American Research* 25 (2): 220-240.

Mehta, Lyla. 2013. "Water and Ill-Being: Displaced People and Dam-Based Development in India." In *The Social Life of Water*, edited by John Richard Wagner, 61-78. Beghahn Books.

Mekonnen, Mesfin M., and Arjen Y. Hoekstra. 2011. "The Green, Blue and Grey Water Footprint of Crops and Derived Crop Products." *Hydrology and Earth System Sciences* 15 (5): 1577-1600.

Messer, Ellen. 1984. "Anthropological perspectives on diet." *Annual review of anthropology* 13 (1): 205-249.

Metropolitan Water District. 2020. "About Your Water." Metropolitan Water District of Southern California. Accessed June 15, 2020. http://www.mwdh2o.com/.

Mihelcic, James R, and Julie B Zimmerman. 2014. *Environmental engineering: Fundamentals, sustainability, design*. 2nd ed.: John wiley & sons.

Miller, James E. 2003. *Review of Water Resources and Desalination Technologies.* Sandia National Laboratories (Albuquerque, New Mexico).

Mintz, Sidney W. 1986. *Sweetness and power: The place of sugar in modern history*. Penguin.

Mintz, Sidney W., and Christine M. Du Bois. 2002. "The anthropology of food and eating." *Annual review of anthropology* 31 (1): 99-119.

Nader, Laura. 1969. "Up the Anthropologist: Perspectives Gained from 'Studying Up'." In *Reinventing Anthropology*, edited by D. Hymes, 284–311. New York: Random House.

---. 1996. *Naked Science: Anthropological Inquiry into Boundaries, Power, and Knowledge*. New York: Routledge.

---. 2010. *The Energy Reader*. John Wiley & Sons.

Nader, Laura, and Stephen Beckerman. 1978. "Energy as it relates to the quality and style of life." *Annual Review of Energy* 3 (1): 1-28.

National Integrated Drought Information System, NIDIS. 2020. "Drought.gov - U.S. Drought Portal." National Integrated Drought Information System. Accessed June 15, 2020. www.drought.gov.

National Research Council. 1980. *Energy Choices in a Democratic Society: The Report of the Consumption, Location, and Occupational Patterns Resource Group, Synthesis Panel of the Committee on Nuclear and Alternative Energy Systems, National Research Council.* National Academies Press (Washington, DC).

National Science Foundation. 2015. Dear Colleague Letter: SEES: Interactions of Food Systems with Water and Energy Systems. Research.gov: National Science Foundation.

Neary, Daniel G, George G Ice, and C Rhett Jackson. 2009. "Linkages between forest soils and water quality and quantity." *Forest ecology and management* 258 (10): 2269-2281.

Nestlé Waters North America. 2020. "Zephyrhills Brand - MadeBetter." Accessed September 24, 2020. https://www.zephyrhillswater.com/made-better.

Nexus. 2014. "Water, Food, Climate and Energy Conference." University of North Carolina. Accessed October 15, 2014. http://nexusconference.web.unc.edu/.

Orlove, Ben, and Steven C. Caton. 2010. "Water sustainability: Anthropological approaches and prospects." *Annual Review of Anthropology* 39: 401-415.

Orr, Yancey, J Stephen Lansing, and Michael R Dove. 2015. "Environmental anthropology: systemic perspectives." *Annual Review of Anthropology* 44.

Oxford University Press. 2020. "Lexico." www.lexico.com.

Pacific Institute. 2014. "Cost Effectiveness of Water Conservation and Efficiency (CE2) Model." Tools and Resources. Pacific Institute. https://pacinst.org.

Park, Alex, and Julia Lurie. 2014. "It Takes How Much Water to Grow an Almond?!". Environment. Mother Jones. Accessed 7/18/2017. https://www.motherjones.com/environment/2014/02/wheres-californias-water-going/.

Parsons, Talcott. 1951. *The Social System*. New York: Free Press.

Pattara, Claudio, Andrea Raggi, and Angelo Cichelli. 2012. "Life Cycle Assessment and Carbon Footprint in the Wine Supply-Chain." *Environmental Management* 49: 1247-1258.

Paulson, Susan, Lisa L Gezon, and Michael Watts. 2003. "Locating the political in political ecology: An introduction." *Human organization* 62 (3): 205-217.

Peet, Richard, and Michael Watts. 1996. *Liberation Ecologies: Environment, Development, Social Movements*. New York: Routledge.

Philpott, Tom. 2014. "Your Almond Habit is Sucking California Dry." Food and Ag. Mother Jones. Accessed August 1, 2015.

Pinney, Thomas. 2007. *A History of Wine in America, Volume 1: From the Beginnings to Prohibition*. Vol. 1. Univ of California Press.

Pongchavalit, Pongchai. 2016. "Assigning guidelines to reduce carbon footprint for domestic small and medium-sized hotel based on the assessment of the carbon footprint for organization (CFO) using Thailand greenhouse gas management organization (Public organization) standard." Master, Sustainable Industrial Management Engineering, Rajamangala University of Technology.

Poore, Joseph, and Thomas Nemecek. 2018. "Reducing food's environmental impacts through producers and consumers." *Science* 360 (6392): 987-992.

Prouty, Christine. 2018. "Wastewater in Context: Systems-based Approaches to Improving Wastewater Infrastructure Transitions." Ph.D. Dissertation, Department

of Engineering, University of South Florida. https://scholarcommons.usf.edu/etd/8137/.

Prouty, Christine, Shima Mohebbi, and Qiong Zhang. 2018. "Socio-technical strategies and behavior change to increase the adoption and sustainability of wastewater resource recovery systems." *Water research* 137: 107-119.

---. 2020. "Extreme weather events and wastewater infrastructure: A system dynamics model of a multi-level, socio-technical transition." *Science of The Total Environment* 714: 136685.

Pryshlakivsky, Jonathan, and Cory Searcy. 2013. "Fifteen years of ISO 14040: a review." *Journal of Cleaner Production* 57: 115-123.

Rancho California Water District, RCWD. 2016. "Where does RCWD's water come from? ." FAQ. Rancho California Water District. Accessed September 23, 2015. http://www.ranchowater.com/FAQ.aspx?QID=80.

Rebs, Tobias, Marcus Brandenburg, and Stefan Seuring. 2019. "System dynamics modeling for sustainable supply chain management: A literature review and systems thinking approach." *Journal of cleaner production* 208: 1265-1280.

Richardson, George P. 1991. "System Dynamics: Simulation for Policy Analysis from a Feedback Perspective." In *Qualitative Simulation Modeling and Analysis*, edited by Paul A. Fishwick and Paul A. Luker, 144-169. New York: Springer.

Riddell, Tom, Jean Schackelford, and Steve Stamos. 1998. *Economics: A Tool for Critically Understanding Society*. Fifth ed. Boston: Addison-Wesley.

Ridolfi, Elena. 2014. "Exploring the urban hydrosocial cycle in tourist environments." *Investigaciones Geográficas* 61: 17-38. https://doi.org/10.14198/INGEO2014.61.02.

Rinaldi, Sara, Emanuele Bonamente, Flavio Scrucca, Maria Merico, Francesco Asdrubali, and Franco Cotana. 2016. "Water and Carbon Footprint of Wine: Methodology Review and Application to a Case Study." *Sustainability* 8 (7): 621.

Rio Carrillo, Anna Merce, and Christoph Frei. 2009. "Water: A Key Resource in Energy Production." *Energy Policy* 37 (11): 4303-4312.

Robbins, Paul. 2012. *Political Ecology: A Critical Introduction*. Malden, Massachusetts: Wiley-Blackwell.

Robinson, Jancis, and Linda Murphy. 2013. *American Wine: The Ultimate Companion to the Wines and Wineries of the United States*. Berkeley: University of California Press.

Rodríguez-Labajos, Beatriz, and Joan Martínez-Alier. 2015. "Political ecology of water conflicts." 537.

Ross, Sharon. 2000. "Functional Foods: the Food and Drug Administration Perspective." *The American Journal of Clinical Nutrition* 71 (6): 1735S-1738S.

Rupp, Stephanie. 2013. "Considering energy: E = mc2 = (magic· culture) 2." In *Cultures of energy: Power, practices, technologies*, edited by S. Strauss, S. Rupp and T. Love, 79-95. Walnut Creek: Left Coast Press.

Sabalow, Ryan, Dale Kasler, and Phillip Reese. 2016. "How plans to save fish species could cut summer water supply." *The Sacramento Bee*, June 21, 2016. https://www.sacbee.com/article83145097.html.

Sackrey, Charles, Geoffrey Eugene Schneider, and Janet T Knoedler. 2008. *Introduction to Political Economy*. Fifth ed. Boston, Massachusetts: Boyertown Publishing.

Santana, Mark V. E., Qiong Zhang, and James R. Mihelcic. 2014. "Influence of water quality on the embodied energy of drinking water treatment." *Environmental Science & Technology* 48 (5): 3084-3091.

Schensul, Jean J., and Margaret Diane LeCompte. 2013. *Essential Ethnographic Methods: A Mixed Methods Approach*. Second Edition ed. Lanham: Rowman Altamira.

Schmidt, Jeremy A. 2014. "Historicizing the Hydrosocial Cycle." *Water Alternatives* 7 (1): 220-234.

Schweitzer, Ryan W., and James R. Mihelcic. 2012. "Assessing sustainability of community management of rural water systems in the developing world." *Journal of Water, Sanitation and Hygiene for Development* 2 (1): 20-30.

Scientific Applications International Corporation. 2006. *Life Cycle Assessment: Principles and Practice.* U.S. Environmental Protection Agency (Washington, DC).

Scott, Christopher A., Suzanne A. Pierce, Martin J. Pasqualetti, Alice L. Jones, Burrell E. Montz, and Joseph H. Hoover. 2011. "Policy and Institutional Dimensions of the Water–Energy Nexus." *Energy Policy* 39 (10): 6622-6630.

Sheridan, Thomas E. 2007. "Embattled ranchers, endangered species, and urban sprawl: The political ecology of the new American West." *Annu. Rev. Anthropol.* 36: 121-138.

Siddiqi, Afreen, and Laura Diaz Anadon. 2011. "The Water–Energy Nexus in Middle East and North Africa." *Energy Policy* 39 (8): 4529-4540.

Siders, David, and Jeremy B. White. 2015. "California Agriculture, Largely Spared in New Water Restrictions, Wield Huge Clout." Last Modified April 3, 2015. Accessed April 30, 2015.

Simms, Jason L. 2013. "Turning Water into Wine: The Political Economy of the Environment in Southern California's Wine Country." Applied Anthropology Ph.D. dissertation, Department of Anthropology, University of South Florida.

Sims, Jacqueline, Global Environmental Epidemiology Network, and World Health Organization. 1994. *Women, health and environment: An anthology.* World Health Organization.

Sitch, Daisy May. 2015. "A Glass Of Red Wine Is The Equivalent To An Hour At The Gym, Says New Study." Accessed September 20, 2020. https://www.huffingtonpost.co.uk/2016/01/08/a-glass-of-red-wine-is-the-equivalent-to-an-hour-at-the-gym-says-new-study_n_7317240.html.

Smith, Adam. 2007 [1776]. *An Inquiry into the Nature and Causes of the Wealth of Nations: Books I, II, III, IV, V*. Amsterdam: MetaLibri.

Southern California Edison. 2016. 2016 Power Content Label: Southern California Edison - Default. https://www.sce.com/sites/default/files/custom-files/pdf/PRG%20Meeting/SCE_PCL_Default.pdf: Southern California Edison.

Spang, Edward. 2012. "A Thirst for Power: A Global Analysis of Water Consumption for Energy Production." Ph.D. dissertation, The Fletcher School of Law and Diplomacy, Tufts University.

Spiegler, K. S., and Y. M. El-Sayed. 1994. *A Desalination Primer: Introductory Book for Students and Newcomers to Desalination*. Balaban Desalination Publications.

State Water Board. 2020. "Home." California State Water Resources Control Board. https://www.waterboards.ca.gov/.

Statista. 2019. "Global wine consumption in 2019, by country." Statista. https://www.statista.com/statistics/858743/global-wine-consumption-by-country/.

Steenwerth, Kerri L, Emma B Strong, Rachel F Greenhut, Larry Williams, and Alissa Kendall. 2015. "Life cycle greenhouse gas, energy, and water assessment of wine grape production in California." *The International Journal of Life Cycle Assessment* 20 (9): 1243-1253.

Sterman, John D. 2000. *Business Dynamics: Systems Thinking and Modeling for a Complex World*. New York: McGraw Hill.

---. 2002. System Dynamics: Systems Thinking and Modeling for a Complex World. Massachusetts: Massachusetts Institute of Technology Engineering Systems Division.

Steward, Julian. 1972. *Theory of Culture Change*. Urbana: University of Illinois Press.

Stott, Philip Anthony, and Sian Sullivan. 2000. *Political Ecology: Science, Myth and Power*.

Strang, Veronica. 2004. *The Meaning of Water*. New York: Routledge.

---. 2013. "Dam Nation: Cubbie Station and the Waters of the Darling." In *The Social Life of Water*, edited by John Richard Wagner, 36-60. Berghahn Books.

Strauss, Sarah, and Devon Reeser. 2013. "Siting, scale, and social capital: wind energy development in Wyoming." In *Cultures of Energy: Power, Practices, Technologies*, edited by Sarah Strauss, Stephanie Rupp and Thomas Love, 110-125. Walnut Creek: Left Coast Press.

Strauss, Sarah, Stephanie Rupp, and Thomas Love. 2013. *Cultures of Energy: Power, Practices, Technologies*. Walnut Creek: Left Coast Press.

Stroshane, Tim. 2016. *Drought, Water Law, and the Origins of California's Central Valley Project*. University of Nevada Press.

Sultana, Farhana. 2015. "Emotional Political Ecology." In *The International Handbook of Political Ecology*, edited by Raymond L Bryant, 633-645. Cheltenham: Edward Elgar.

Swyngedouw, Erik. 2009. "The Political Economy and Political Ecology of the Hydro-social Cycle." *Journal of Contemporary Water Research & Education* 142 (1): 56-60.

Systems Dynamics in Education Project. 2020. "ATHENA Page for System Dynamics in Education." Sloan School of Management. Accessed September 24, 2020. http://web.mit.edu/sysdyn/index.html.

Thomas, Michelle L. 2020. "Hotel Water Management in California." Ph.D., College of Management and Technology, Walden University.

Thone, Frank. 1935. "Nature Ramblings: We Fight for Grass." *The Science News-Letter* 27 (717): 14-14.

U.S. Environmental Protection Agency. 2020. "eGrid Data Explorer." Accessed October 5, 2020. https://www.epa.gov/egrid/data-explorer.

Ulijaszek, Stanley. 2018. "Nutritional Anthropology." *The International Encyclopedia of Anthropology*: 1-10.

Ulin, Robert C. 2013. "Terroir and locality: An anthropological perspective." In *Wine and Culture: Vineyard to Glass*, edited by Rachel E. Black and Robert C Ulin, 67-84. London: Bloomsbury.

UN-Water. 2013. *Water Security and the Global Water Agenda: a UN-Water Analytical Brief.* United Nations University (Hamilton, Ontario).

United Nations. 2020. "The Sustainable Development Agenda." Sustainable Development Goals. Accessed June 15, 2020. https://www.un.org/sustainabledevelopment/development-agenda/.

United Nations Development Programme. 2014. "What is Water Governance?". UN Sustainable Development. Accessed March 20, 2014. https://www.un.org/sustainabledevelopment/development-agenda/.

Title 21 - Federal Food, Drug, and Cosmetic Act. January 7, 2011.

USDA Foreign Agricultural Service. 2014. *Saudi Arabia: Grain and Feed Annual.* United States Department of Agriculture.

USDA National Agricultural Statistics Service. 2020. "2019 State Agriculture Overview - California." Accessed June 15, 2020. https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=CALIFORNIA.

Vandone, Daniela, Massimo Peri, Lucia Baldi, and Alessandra Tanda. 2018. "The impact of energy and agriculture prices on the stock performance of the water industry." *Water resources and economics* 23: 14-27.

Vayda, Andrew P., and Bradley B. Walters. 1999. "Against Political Ecology." *Human Ecology* 27 (1): 167-179.

Veeravalli, Swathi. 2013. "Kenyan Landscape, Identity, and Access." In *The Social Life of Water*, edited by John Richard Wagner, 138-53. New York: Berghahn Books.

Venkatesh, G. 2019. "Critique of selected peer-reviewed publications on applied social life cycle assessment: focus on cases from developing countries." *Clean Technologies and Environmental Policy* 21 (2): 413-430.

Verbyla, Matthew E, Stewart M Oakley, and James R Mihelcic. 2013. "Wastewater infrastructure for small cities in an urbanizing world: integrating protection of human health and the environment with resource recovery and food security." *Environmental Science & Technology* 47 (8): 3598-3605.

Vondrasek, Diane. 2015. "Welcome to the drought, California hotels." GreenBiz. Accessed June 15, 2019. https://www.greenbiz.com/article/welcome-drought-california-hotels.

Wagner, John Richard, ed. 2013. *The Social Life of Water*. New York: Berghahn Books.

Walker, Alissa. 2015. "If We're Going to Do Celebrity #DroughtShaming Let's Do It Right." Gizmodo. Accessed August 1, 2015.

Walker, George M, and John Peragine. 2017. *Cucamonga Valley Wine: The Lost Empire of American Winemaking*. Arcadia Publishing.

Walker, Peter A. 2005. "Political Ecology: Where is the Ecology?" *Progress in Human Geography* 29 (1): 73-82.

Watts, Michael. 2000. *Political Ecology.A Companion to Economic Geography*.

---. 2003. Berkeley.

Weber, Edward, Stephen R. Grattan, Blaine R. Hanson, Gaetano A. Vivaldi, Roland D. Meyer, Terry Prichard, and Larry J. Schwankl. 2014. "Recycled Water Causes No Salinity or Toxicity Issues in Napa Vineyards." *California Agriculture* 68 (3): 59-67.

Wells, E. Christian, Rebecca K. Zarger, Linda M. Whiteford, James R. Mihelcic, Eric S. Koenig, and Maryann R. Cairns. 2016. "The Impacts of Tourism Development on Perceptions and Practices of Sustainable Wastewater Management on the Placencia Peninsula, Belize." *Journal of Cleaner Production* 111: 430-441.

White, Leslie A. 1943. "Energy and the evolution of culture." *American Anthropologist* 45 (3): 335-356.

Winans, Kiara S, Ilan Macadam-Somer, Alissa Kendall, Roland Geyer, and Elias Marvinney. 2020. "Life cycle assessment of California unsweetened almond milk." *The International Journal of Life Cycle Assessment* 25 (3): 577-587.

Wine Institute. 2019. "California & US Wine Production." Accessed December 15, 2019. https://wineinstitute.org/our-industry/statistics/california-us-wine-production/.

Wolf, Eric. 1972. "Ownership and Political Ecology." *Anthropological Quarterly* 45 (3): 201-205.

---. 1982. *Europe and the People without History*. Berkeley: University of California Press.

World Economic Forum. 2011. *Global Risks 2011: An Initiative of the Risk Response Network.* World Economic Forum (Switzerland).

Yelvington, Kevin A., Laurel D. Dillon-Sumner, and Jason L. Simms. 2014. "Pleasure policies: debating development plans in southern California's Wine Country." *Journal of Policy Research in Tourism, Leisure and Events* 6 (2): 95-118.

Yelvington, Kevin A., Jason L. Simms, and Elizabeth Murray. 2012. "Wine Tourism in the Temecula Valley: Neoliberal Development Policies and Their Contradictions." *Anthropology in Action* 19 (3): 49-65.

Yoo, Yung J., Anthony J. Saliba, and Paul D. Prenzler. 2010. "Should Red Wine be Considered a Functional Food?" *Comprehensive Reviews in Food Science and Food Safety* 9 (5): 530-551.

Appendix A

IRB Approval and Guiding Interview Questions

USF
UNIVERSITY OF
SOUTH FLORIDA

RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
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3/24/2016

Zaida Darley
Anthropology
4202 East Fowler Ave
Tampa, FL 33620

RE: **Expedited Approval for Initial Review**
IRB#: Pro00023740
Title: The Food, Energy, and Water Nexus of Temecula Valley Wine Country (NSF# 1261812)

Study Approval Period: 3/21/2016 to 3/21/2017

Dear Ms. Darley:

On 3/21/2016, the Institutional Review Board (IRB) reviewed and **APPROVED** the above application and all documents contained within, including those outlined below.

Approved Item(s):
Protocol Document(s):
Edited Study Protocol Feb 25

Consent/Assent Document(s):
Informed Consent
Informed Consent in Spanish

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural

beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

For the interviews your study qualifies for a waiver of the requirements for the documentation of informed consent as outlined in the federal regulations at 45CFR46.117(c) which states that an IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either: (1) That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or (2) That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval via an amendment. Additionally, all unanticipated problems must be reported to the USF IRB within five (5) calendar days.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John Schinka, Ph.D., Chairperson
USF Institutional Review Board

USF
UNIVERSITY OF
SOUTH FLORIDA

RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-7091

3/13/2019

Zaida Darley,
Anthropology
124 S. Franklin Street

Tampa, FL 33602

RE: **Expedited Study Determined Exempt at Continuing Review**
IRB#: CR3_Pro00023740
Title: The Food, Energy, and Water Nexus of Temecula Valley Wine Country (NSF# 1261812)

Study Approval Period: 3/12/2019

Dear Dr. Darley:

On 3/12/2019 11:19 AM, the Institutional Review Board (IRB) reviewed and **APPROVED** the above application and all documents contained within including those outlined below. Please note that this protocol is now approved under the 2018 Common Rule (45 CFR 46) and is **now exempt**. Thus, **Continuing Review is no longer required** and your application will be closed per USF HRPP policy.

The IRB determined that your study qualified for exempt review based on criteria for exemption in the federal regulations as outlined by 45 CFR 46.104(d):

(2) Research that only includes interactions involving educational tests(cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met:(i) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects; (ii) Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or (iii) The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by 45 CFR 46.111(a)(7).

As the principal investigator for this study, it is your responsibility to ensure that this research is conducted as outlined in your application and consistent with the ethical principles outlined in the Belmont Report and with USF HRPP policies and procedures.

Please note, as per USF HRPP policy, once the exempt determination is made, the application is closed in ARC. This does not limit your ability to conduct the research. Any proposed or anticipated change to the study design that was previously declared exempt from IRB oversight must be submitted to the IRB as a new study prior to initiation of the change. However, administrative changes, including changes in research personnel, do not warrant an Amendment or new application.

We appreciate your dedication to the ethical conduct of human subjects research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

Kristen Salomon, Ph.D., Chairperson
USF Institutional Review Board

Guiding Interview Questions

1. Do you think wine is food?

2. Do you know where the water that irrigates the vineyard comes from? The water that is used in winemaking or the hotels and restaurants?

3. Who makes decisions over water and energy use and conservation at your vineyard and/or winery?

4. What is the energy source used to treat and distribute water? What is the energy source used to run the winery, tasting room, and hotel and/or restaurant?

5. How has the drought impacted you?

6. What do you think are the best uses of water in the Temecula Valley region (e.g., residential, tourism industry, wine industry)?

7. How much water does it take to irrigate vineyards and at what intervals and time of season? How does this use impact the quality of the wine?

8. What makes your wine unique in this valley?

9. How much water does it take for use in winemaking?

10. How do you see water and energy used in the tourism industry? Can you give me an idea of the percentage of your total water bill that is devoted to irrigating the vines? What about in other uses, like cleaning equipment at the winery, or in the tasting room? Watering the flowers and lawn? Hotel?

11. Where does the used water (waste water) go?

12. What do you think of the Wine Country Community Plan as proposed by the Riverside County Planning Department? Do you think it will improve or harm the local wine industry? How will it affect the cost and availability of water and energy?

13. Does the agriculture sector pay a different amount for water and/or energy than residence? Is there different access to water and/or energy between the agricultural and residential sectors?

14. How many acres make-up this vineyard / winery? How is it broken up (e.g., how much for the vineyard, winery, hotel)? Who owns it at present?

15. Are there any acres of land on this property that are not farmed for grapes? Why? What other use could that land have?

16. Is there enough land for the expansion of the wineries? Enough water?

17. Do you think the community in general has enough water?

18. What gender do you identify as (male, female, or other)?

19. What ethnicity do you identify as?

20. What is your age?

Appendix B

Copyright Permission

Darley, Zaida

From: Permissions <permissions@motherjones.com>
Sent: Tuesday, October 27, 2020 12:36 PM
To: Darley, Zaida
Subject: RE: Reprints Form Submission

Thank you, Zaida. That works for me.

Jamie

Jamie Maloney
Senior Marketing and Media Sales Manager
(805) 807-5673 | jmaloney@motherjones.com
Mother Jones
The Road Forward: Book the January/February today

From: Darley, Zaida <zdarley@usf.edu>
Sent: Monday, October 26, 2020 4:39 PM
To: Permissions <permissions@motherjones.com>
Subject: Re: Reprints Form Submission

Hi Jamie,

Thank you! At this time it's only for my dissertation, however it will be made available online through ScholarCommons.usf.edu. When I publish in a more widely published work, I will reach out to you again. Is that okay?

Zaida

> On Oct 26, 2020, at 6:48 PM, Permissions <permissions@motherjones.com> wrote:
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> Hi Zaida,
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> Thank you for reaching out. Just to confirm, you would this graphic in your dissertation? Would you be using it in a more widely published work?
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> If it will be for your dissertation only, permission is granted, without fee.
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> Thank you!
>
> Jamie
>
> Jamie Maloney
> Senior Marketing and Media Sales Manager
> (805) 807-5673 | jmaloney@motherjones.com
> <image003.png>
> **The Road Forward: Book the January/February issue by October 23**

From: Zaida Darley <donotreply@wordpress.com>
Sent: Monday, October 26, 2020 8:22 AM
To: Permissions <permissions@motherjones.com>
Subject: Reprints Form Submission

Contact Name: Zaida Darley

Contact Phone: 813-782-8898

Email: zdarley@usf.edu

Publisher: University of South Florida

Address: 4202 E Fowler Ave., Tampa, FL 33620

Publication Name: Save Water Drink Wine: Challenges of Implementing the Ethnography of the Temecula Valley Wine Industry into Food-Energy-Water Nexus Decision-Making

Expected Print Run (or Site Traffic): December 2020

Date of Reprint:

Title of Article Seeking to Reprint: It Takes How Much Water to Grow an Almond?!

Name of Author: Alex Park and Julia Lurie

Article Link(s): https://www.motherjones.com/environment/2014/02/wheres-californias-water-going/

If you'd like to reprint photography, charts, videos, or other interactive forms of reporting, please specify those here: How Thirsty is Your Food figure

Quick description of your request: Hi, I am working on my dissertation in anthropology about increasing wine tourism in Southern California during a drought. One of the messages my participants would share with me is how grapes use less water than almonds. I cite this article by Park and Lurie as one of the media sources for the information in my dissertation. I want permission to use your figure on How Thirsty is Your Food. Thanks for your help.

Time: October 26, 2020 at 11:21 am
IP Address: 47.200.207.189
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