THE LEAST OF THESE MY BRETHREN:

STORIES OF DROUGHT POLICY IMPACTS ON

SMALL-SCALE FAMILY FARMS OF GOLETA, CALIFORNIA

A dissertation submitted

by

DENNIS P. GERMAN

to

FIELDING GRADUATE UNIVERSITY

In partial fulfillment of the
requirements for the degree of

DOCTOR OF PHILOSOPHY

in

HUMAN AND ORGANIZATIONAL SYSTEMS

This dissertation has been accepted for
the faculty of Fielding Graduate University by

Annabelle L. Nelson, PhD
Committee Chair

Committee:
Richard P. Appelbaum, PhD, Faculty Reader
David Blake Willis, PhD, Faculty Reader
Marc Hanlan, PhD, Student Reader
Casey Walsh, PhD, External Reader

THE LEAST OF THESE MY BRETHREN:
STORIES OF DROUGHT POLICY IMPACTS ON SMALL-SCALE FAMILY FARMS OF GOLETA, CALIFORNIA

by

DENNIS P. GERMAN

Abstract

In this study of small-scale farmers in Goleta, California, questions were answered regarding the impacts of Goleta Water District policy during the recent drought. Urban agriculture represents a community-supported innovative endeavor within the city of Goleta contributing fresh locally grown produce, among other benefits. The hardy souls who ply this trade expressed frustration with the lack of consideration written into the Goleta Water District drought policies. Yet farmers these labored on with hearts intent upon continuing their noble calling with the hope that it might also be a legacy for their children. Ethnographic case-study methods were employed to assess the evolving conditions of a small-scale family-run farm throughout the recent drought. Each farmer told his own story of a discreet lived experience, yet they were all in congruence. From these an inference may be drawn of the Goleta Water District drought policy influence.

KEYWORDS: AGRICULTURE, CACHUMA, FARMER, GOLETA, POLICY, WATER

……..

STORIES OF DROUGHT POLICY IMPACTS ON SMALL-SCALE FAMILY FARMS

ACKNOWLEDGEMENTS

Many thanks to family and friends who continuously encouraged me

My loving committee

The Fielding Graduate University Faculty who helped me see with my heart

The dedicated farmers who bared their souls before me so we could hear their stories

DEDICATION

Elsie and LenLen, you have been the cornerstone that kept me standing though convinced I was falling. If it were not for your patience and encouragement, I would never have made it. You are my rock!

Table of Contents

LIST OF FIGURES AND TABLES

APPENDICES

Why do we do this to ourselves?

They're starving in the street
yet others have too much to eat.
Oh, why don't we care?
why don't we share?
their empty eyes cry out
but we don't care or think about
the brethren and friend
when will it end?

They try to steal the soul
and still they want to keep you whole
But it's all a lie
these things you can't buy
the precious life alone
no price enough to pay or own
Oh, why don't we see?
all should be free

The earth is crying out
but we don't hear or care about
the damage we cause
or all that is lost
it was a plain command
direction for the sea and land
to dress and to keep
instead we just reap

Why do we do this to ourselves?
Why?

Dennis P. German (2005)

CHAPTER ONE: THE PHENOMENON

I grew up in Ojai, California and then joined the US Navy which took me to the other side of the world but left me in Virginia. When I finally came back to California I settled in Goleta, a town in Santa Barbara County on the southern end of the California Central Coast. The area is known for being well suited for agricultural pursuits. However, the year I moved here (2012), a major drought was beginning to impact the area. As I drove by the many orchards, on my way to and from school, work, shopping or play, I noticed that the various trees were slowly changing color from a luscious green to a brownish hue. In some cases, the proprietors eventually had to cut down their orchards and burn the dead trees.

The town of Goleta is not a large area and the farms and ranches there are small in comparison to those operated by corporate conglomerates in other areas. Nestled on the transverse segment of the central coast of California, this city of about thirty thousand has a history that includes a home for the indigenous tribe of the Chumash and the harbor where the Conquistadores of Spain anchored their galleons. Previously an unincorporated area of Santa Barbara County, it became an incorporated city in 2002 (City of Goleta, 2018).

As I considered the drought (State of California, 2014) and the readily observable local impacts (Goleta Water District, 2014 September), I felt that the effect on my family, as a local residential water customer, was negligible. Even if I had a lawn, I would not have had a problem with it turning brown because of watering restrictions. At the worst, the family cars might not be washed as regularly as one might hope, resulting in the paint finish being damaged. Such a loss would pale in comparison to the family means of

subsistence being impaired, which was the case with the small-scale farmer (Goleta Water District, 1 August 2018). It occurred to me that what would be a minor inconvenience to residential water customers could be the death knell to a small family-operated farm. In addition, there would also be the effect on the vendors who provide goods and services to the farming operation as well as the workers who would not have jobs to support their families. In short it appeared that there might be a social injustice underway. That is, perhaps the failing crops of these farms that I was observing was as a result of the Goleta Water District favoring the residential customer, the largest voting bloc, at the expense of the agricultural users.

Though the academic community is anticipated to be the immediate recipient of this work it would have a greater impact if presented to those with the power to remedy the situation. In a paradigm where the power is in the people, the audience would then be the general population but particularly the voting population. Specifically, this work will be made available to the Goleta Water District rate payer community and presented at a meeting of the Goleta Water District Board or special meeting for addressing this issue.

The net result would hopefully be some policy changes that would aid the small-scale farmers in Goleta, California. With only one exception, the Goleta Water District policies for dealing with water shortages currently restrict agricultural usage as they do all other users. It was only in Stage II that agricultural users were exempt from the 2 day a week restriction under the “landscape watering” section (Goleta Water District, 2014, September). The agricultural users were not impacted by the policy until a Stage III water shortage emergency was declared. It would stand to reason that with the agriculture community only representing 20% of the district water demand, any reduction would have minimal impact,

whereas a reduction in the residential user community would have a much greater impact on water savings (Goleta Water District, 2014, July, p. 2-8). By extension, small-scale farmers in other locations, where they are or may be dealing with water scarcity, might be aided if a precedent were set in Goleta.

The purpose of this research is to determine the real-life consequences of the intersectionality of water scarcity and the water policies on the small-scale crop farmers, particularly those which are family owned and operated which rely on the Goleta Water District as their primary source of irrigation water.

Research Questions

What stories do small-scale family farmers, who purchase their irrigation water from the Goleta Water District, tell of the challenges, policies, and issues during conditions of water shortage?

How would the small-scale farmer describe the impact of policies as implemented by the Goleta Water District Board, that deal with Goleta's water shortage challenges?

Summary

The area of Goleta, California has suffered and survived this most recent drought as it has many others before. However, the climate history of the area portends an estimated four multiyear droughts during the 21st century. Since the less recent historical data from tree rings indicates drought durations in multiple decades, it would behoove the powers to be to follow the Boy Scout motto and be prepared.

These stories should be instructive in telling of the far-reaching impacts of a municipal policy. Allowing commercial, light industrial and residential development of the area, without forward thinking might lead to much worse stories being told from future

droughts. In conjunction with devising a cost paradigm that does not penalize the farming community, droughts that are certain to come might not be as impactful on the farmer and by extension the consumer who relies on them for sustenance.

CHAPTER TWO: LITERATURE REVIEW

The Planet, Water and Humanity

Water as life and a human right.

Water is such an important component to sustaining human life that the United Nations has declared it a human right to have access to safe drinking water and sanitation (General Assembly, UN, 2010). It had been reported that this same conclusion had been arrived at as early as 1977, when the Mar del Plata conference stated that ". . . all peoples, whatever stage of development and their social and economic conditions, have the right to have access to water in quantities and of a quality equal to their basic needs" (Gleick, 1996). It was further stated that the 1992 Earth Summit in Rio De Janeiro strongly reaffirmed this position expanding it to include ecological water needs (Gleick, 1996). It was also recommended that a standard of 50 liters per person per day be adopted by all levels of government. This amount would vary depending the factors such as climate or culture (Gleick, 1996).

The World Health Organization (WHO) specifies a graded service level which considers 50 liters per day as an intermediate standard, whereas 100-200 liters would be optimal (WHO, 2003). This system of gradation, derived from previous work (Howard & Bartram, 2003), also describes the circumstances of water collection based upon how far one might travel or how long it would take to get the water.

Though there is an abundance of water on the planet, there are many who do not have a sufficient supply, or their source is at best questionable and at worst toxic (Gleick, 1999). The reasons for this are many, but if we are to survive, we must overcome them to the extent that there is at least the bare minimum to sustain life (Howard & Bartram, 2003, p. 5).

Data was developed from research that identified specific values of necessary hydration depending upon the various efforts and activities of an individual (Kleiner, 1999). The impacts of dehydration on metabolism and physiology in humans infer derivative values of water need as well as vulnerabilities and rick level for certain potential resultant disorders (Kleiner, 1999, p. 202).

In 1996 Basic Water Requirements for Human Activities: Meeting Basic Needs was published (Gleick, 1996). The content included the findings of exhaustive research into the various human uses of water. These results gave exacting details of the several purposes of water, including drinking, food preparation, bathing and waste disposal (Gleick, 1996, pp. 83-85). At the time of its writing, there had been no satisfactory analysis of the additional use of water related to the processes of growing food necessary to meet the minimum caloric requirements for human survival (Gleick, 1996, p. 86). Hence, the actual value required for this critical function could then only be estimated. These findings were later augmented the previous estimates with specific values for food production and processing as well as basic hygiene (Kleiner, 1999, p. 201). At the time, other efforts were afoot to address the issue of meeting basic human needs for water (Gleick, 1996, p. 88). These included efforts to integrate environmental issues as well as sustainable economic and social development. This produced the concept of "Basic Water Requirement" (BWR) whereby access to at least 50 liters of clean water per person per day (l/p/d) should be considered a fundamental human right (Gleick, 1996, p. 90). Various factors can increase the individual water requirement, such as age, body mass size and pregnancy (Howard & Bartram, 2003, p. 5).

In 1999 a continuation of Basic Water Requirements for Human Activities: Meeting Basic Needs (Gleick, 1996, p. 88) was published. This tome updated the 1996 paper with

fresh data and a new title: The Human Right to Water (Gleick, 1999). The 1996 data indicated that nearly one billion people lacked access to the standard specified as the BWR (Gleick, 1996, p. 88). During the interceding three years that number had exceeded one billion. At that time almost three billion people did not have access to adequate sanitation facilities. These conditions were believed to lead to substantial, unnecessary human suffering which was preventable. It was estimated that 14 to 30 thousand people were dying daily because of water-related disease; most of these being the young or elderly (Gleick, 1999, p. 2). The death toll from diarrhea alone, resulting from a water supply of poor quality, is estimated to be over 4 thousand per day (Howard & Bartram, 2003, p. 1) and exceeds that from HIV/AIDS (HIV.gov, 2018)

> "in some ways this right to water is even more basic and vital than some of the more explicit human rights already acknowledged by the international community, as can be seen by its recognition in some local customary laws or religious canon" (Gleick, 1999, p.2)

The Human Right to Water enumerates various acknowledgements from this body dating as far back as 1948 (Gleick, 1999, p. 4). None specifically speaks to a fundamental human right to access adequate clean water however only a right to a standard of living. The question is posed, "is water so fundamental a resource, like air, that it was thought unnecessary to explicitly include reference to it at the time these agreements were forged?" (Gleick, 1999, p. 4). The answer to this question is most likely yes, stating that without water, life cannot be sustained beyond a few days (Howard & Bartram, 2003, p. 1).

The Human Right to Water concludes with a formulation which would be suitable as a component of the declarations of human rights extant. “All human beings have an inherent right to have access to water in quantities and of a quality necessary to meet their basic

needs. This right shall be protected by law". (Gleick, 1999, p. 11). The World Health Organization (WHO) report on the Ecosystem and Human Well-Being (Corvalan, Hales, & McMichael, 2005) indicates that the WHO assessment team came to essentially the same conclusion as Gleick, stating, "for the human species and all other forms of life. Human biology has a fundamental need for food, water, clean air, shelter and relative climatic constancy" (Hancock, 2013, slide 17). Further, the team specified similar values for the minimum amount of clean water for each person.

The efforts of Gleick, et al, contributed to the United Nations' eventual passage of resolution A/RES/64/292, The human right to water and sanitation on August 3, 2010 (General Assembly, UN, 2010, p. 1). The resolution acknowledged the import of equal access to clean water and sanitation as a fundamental element of basic human rights. It further affirmed the duty of governments to promote and protect this right. To that end a commitment was made by the signatory states to achieve the requirements of the Millennium Development Goals; to reduce the number of people who do not have access to safe water to half the value by 2015 (General Assembly, UN, 2010, p. 2). In October of the following year the UN Human Rights Council passed A/HRC/RES/18/1, The human right to safe drinking water and sanitation.

Global view: climate change and water scarcity.

Climate change is a major factor in bringing about food shortages. Specific events include extremes in weather, heatwaves, droughts and floods. Droughts leave the small-scale farmer at risk since natural sources of irrigation are reduced. This is particularly an issue in developing countries as well as impoverished regions of developed nations (Pagdham, 2009). Combined with potential financial crises these climate driven events will have an elevated

negative impact (Alwang & Norton, 2011, p. S140). These realities have a particular impact on the small-scale/smallholder farmers. With little or no governmental or collective supports the prospect of a cascading family catastrophe are very real (Alwang & Norton, 2011, p. S139).

These issues prevail in virtually every part of the globe. Efforts are underway in some nations to minimize these impacts by way of price controls. Nations of note include the Americas, Ethiopia, Egypt, Indonesia, Mexico and Morocco (Alwang & Norton, 2011, p. S141). In Mexico, the rural poor farmers are eligible for cash pay outs if their children will stay in school. In addition to the general support of the small-scale family farmers, there is the added benefit (and perhaps more important) that increasing school attendance, which enhances the possibility of the next generation rising out of poverty (Alwang & Norton, 2011, p. S144).

Since water plays a prominent role in agricultural production, scarcity of water, therefore has a significant negative impact on any farming operation (Roco, et al, 2013, p. 958). The global nature of this scarcity is expected to become worse in the coming years (Sheffield, Wood & Roderick, 2012, p. 435). Water consumption by agricultural efforts tend to utilize most of water supply of any locality (Roco, et al, 2013, p. 969). It stands to reason that continued pace of climate change driven weather anomalies will affect the small-scale farmer at an increasing rate.

Local issues.

The impact on the small scale-farmer is generally as a result of at least two issues: decrease precipitation and increased development in the community; the combination leading to a condition of water scarcity. As with water scarcity issues from around the globe, the

circumstance in the Central Coast of California has been (Fagan, 2003, p. 30-31) and is (Hundley, 1992, p. 400-401) essentially the same. The early inhabitants, mainly the Chumash tribe, contended with droughts regularly from the age of hunter-gatherers to the eventual farmers of the acorn (Gamble, 2005, p. 93).

Despite the droughts, the acorn was an ever-present asset, due to the variety of oak species and abundance of natural groves (Fagan, 2003, p. 30-31). In addition, the El Niño-Niña cycle only marginally impacted the supply of seafood, thus providing sufficient sustenance for the tribe (Fagan, 2003, p. 32-33). Still, the relative lean times required agricultural and fishing processes to be well organized to ensure equitable distribution of food. In times of abundance the tribe operated in an egalitarian mode with little need for direction from the elders. As supplies lessened stricter organization was implemented by those known as the "Big Men" (Fagan, 2003, p. 178).

Today, the subsistence of the agricultural community is subject to the potential of the same natural disasters experienced by their predecessors (Solomon, 2010, p. 12). Not unlike those "Big Men" aggrandizers of old, there are those who attempt to, and occasionally successfully, corner the water market through affluent connections, thus short changing the small-scale farmer, whose voice is too small to have any impact (Zenovich, 2017). In the case at hand the aggrandizers would appear to be the Goleta Water District board of directors and professional staff. Whether there was any untoward effort on their part would require an in-depth investigation.

Since 1944 the authorities in Goleta, California have been aware of the prospect of an issue with providing adequate water for their growing community. There have been efforts to engage policies and processes which were intended to meet the needs of flourishing

agriculture and industry as well as an expanding residential customer base. This was evident in the construction of the Bradbury Dam on the Santa Ynez river, creating Lake Cachuma, drilling additional wells in the Goleta aquifer and contracting to receive water from the California Water Project (Goleta Water District, 2020b). However, the results have been less than satisfactory as successive drought events have often left the city with a shortage of water (Goleta Water District, 2014, July).

The recent drought condition in Goleta, California should serve as a wakeup call to the rest of humanity. A detailed analysis of the circumstances of the Goleta drought offers lessons that may be applied to other locations or even on a global scale. Based upon the contribution to the small-scale farmer to the crop production in the United States (MacDonald, Korb, & Hoppe, 2013, p. iv) the generalization can be made that there is the potential for a similar situation of issues to impact a greater number than just those in Goleta, California.

Goleta is not an out of the way location of minimal means and affluence; it is a city in a sought-after location that is well known for the celebrity residents and vacation destinations, yet Goleta has a community of one hundred sixty-six Goleta Water District connections which are designated as agricultural (Goleta Water District, 2017, May, p. 55). A few of these would be classified as “small-scale”. The definition of the small-scale farm is one where the Gross Cash Farm Income is less than $350,000 per year (USDA 2015, p. iii). Based upon this standard, all farms purchasing their irrigation water from the Goleta Water District are small-scale farmers.

With public policy (regarding water scarcity) requiring the reduction in water use to all users, agriculture cannot continue to irrigate as they would during periods of normal water

availability (Goleta Water District, 2014, July, p. 4-7). Without additional water from precipitation or private well, Goleta small-scale farmers are guaranteed to have lower crop yields (Steduto, et al, 2012, p. 1).

During the recent drought conditions, the per capita water use in California, at large, fell from 178 gallons per day 130 (Mount & Hanak, 2016). With agricultural water use constituting 80% of all water use in the state, crop yields for farmers who rely solely on public utilities for irrigation, have suffered to some extent. Fortunately, for the farmers sake, crop yield has improved in the decades since the late 19th century, because of greater scientific knowledge and application as well as advances in technology (Hanak, et al, 2011, p. 171).

Since small-scale family farms constitute 87% of crop production, in the United States, the potential loss is no small issue (MacDonald, Korb, & Hoppe, 2013, p. iv). Analyses of small-scale farmers are few and far between. Jara-Rojas, et al (2012) speak to the improvements observed in those of Central Chile because of implementing water conservation practices. Amsalu, et al (2006) addresses the use of stone terraces in Ethiopia and Sidibé restoration of degraded soils in Burkina Faso (2005).

Though these studies are valuable, in that they discuss different methods for improving any farming operation, they make no effort to express the human toll when even the best systems are employed during a condition of water scarcity. This study will add to the discussion by delving into the heart and soul of the small-scale farmers life.

Net impacts.

Whether we speak of a global or local paradigm, the same factors impede or promote the agricultural efforts. The impediments to food production through the ages have

undergone very little change. In our location of focus (California Central Coast, in general, and the city of Goleta, in particular) though there is no intertribal warfare, as in the ancient past, the issues of social standing can impact the ability for a specific operation or group to produce sufficient crops to be financially solvent. In the end it is the access to an adequate water source that determines whether there will be success or failure. This has ever been the driving force in agriculture, whether the historical domestication of crops or the hunting and gathering of our ancient ancestors. Water is the "life blood" of all living entities on planet Earth as well as all those species which have been long extinct (Ash, Hanson & Norman, 2002, p. 6).

Droughts bring death to humanity at various levels. First there is the obvious dehydration. There is also the famine that follows that brings death by starvation. Leadership may provide guidance that manages the various factors impacted by these cascading natural disasters. However, with the unpredictable nature of climate change, the complexities of this sequence can exceed even the best laid plans (Devereux, 2000, p. 4).

Critical policy perspectives on water in a drying world.

Water scarcity can be expected to be a consistent issue for the foreseeable future (Ingram & Malamud-Roam, 2013, p. 8). Water shortage began to be an issue of concern for about 2% of the world population in the year 1900. By 2005 that number had increased such that 35% of the world population was under a chronic water shortage condition (Kummu, et al, 2010, p. 1).

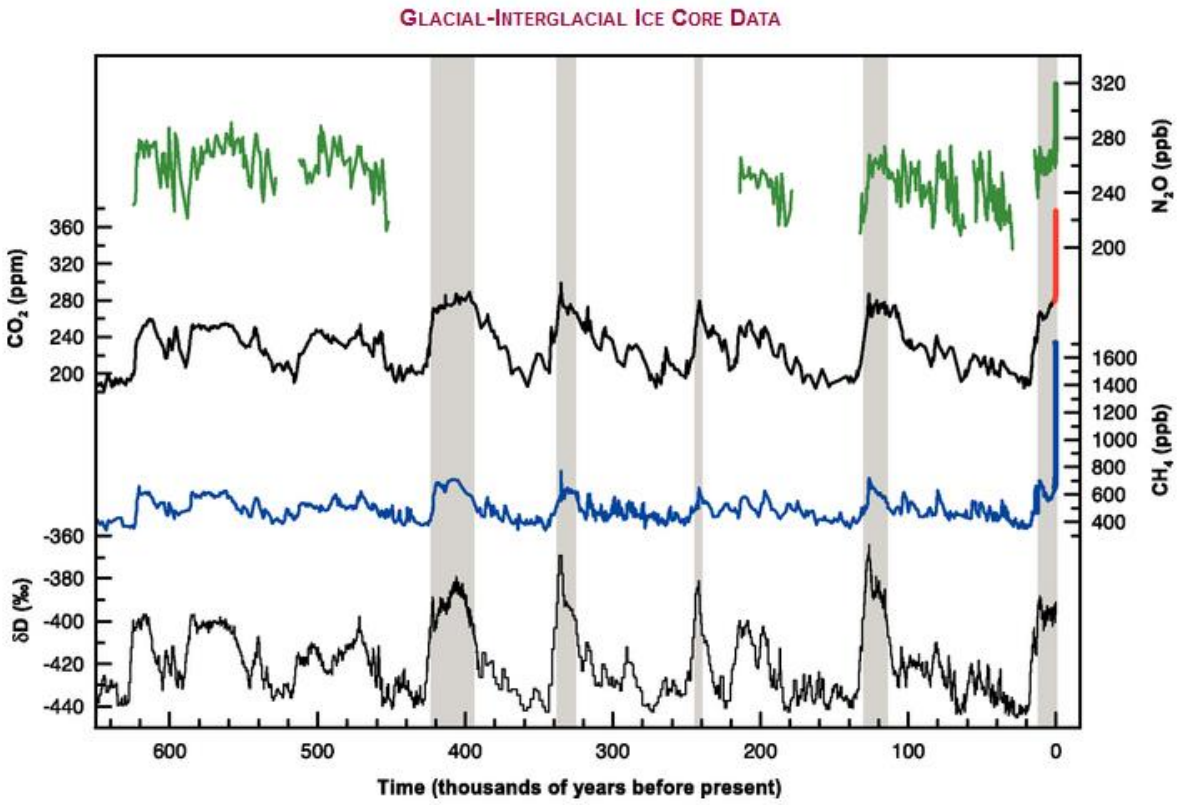


Figure TS.1. Variations of deuterium (δD) in antarctic ice, which is a proxy for local temperature, and the atmospheric concentrations of the greenhouse gases carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) in air trapped within the ice cores and from recent atmospheric measurements. Data cover 650,000 years and the shaded bands indicate current and previous interglacial warm periods. {Adapted from Figure 6.3}

Figure 1 - 800,000 Years Carbon Dioxide Data (Luthi, et al, 2008)

Ice core data indicates that during the most recent deglaciation (also known as an interglacial period) both global temperature and atmospheric carbon dioxide concentration of the planet increase significantly just before the onset of the last glacial epoch (Shakun, et al, 2012). Since our current period is essentially an interglacial period, it can be assumed that this behavior will be replicated (Rohling, et al, 2019, p. 2).

With the continuing global drought, the state of California in general, and the city of Goleta have regularly experienced a general state of water supply emergency (Goleta Water

District, 2018). The requirements established by the Goleta Water District Board of directors stipulates certain reductions in water use by all users connected to the district supply system (Goleta Water District, 2014, July).

Though all water customers are impacted by these restrictions, residential connections, the main users in the community (of which I am a member), are not affected in a manner that would be a general danger to their lives or health. The primary issue to deal with is that of landscaping on personal property (Goleta Water District, 2014, July, p. 4-3).

However, in addition to the reduction in water availability from the Goleta Water District the sinking water table makes the natural subsurface supply harder to reach (Glazer, & Likens, 2012, p. 657). Thus, the implementation of drought regulations, that negatively impact the agricultural community, only exacerbates the problems experienced by the agriculture community. An ideal policy might consider the human value impacts rather than simple arbitrary percentages for reduction and set timeframes for watering allowance.

Inference.

These points can be seen from this study, which are immutable; humanity has certainly had an impact on the climate while our rudimentary animal nature tends to be self-serving. In this vein it is posited that policies tend to be devised to favor the affluent at the expense of the poor. However, the elements of this universe, including our planet, mostly behave without any consideration for our benefit.

The value of the small-scale farmer is not well understood by the general populace (Stumbos, 1993). Too often it is stated that, in California, agriculture uses 80% of the water but only contributes 2% of the gross product (Mount & Hanak, 2016). This comparison is the classic “apples and oranges” analogy. The most recent data reported by the Bureau of

Economic Analysis, the industries of Information Educational services, health care, and social assistance, Finance, insurance, real estate, rental, and leasing Government, Professional and business services, constitute a total of 62% of California GDP (U.S. Department of Commerce, 2018). Yet these industries clearly do not require water as a major contributor to their production whereas without water there would be no agriculture.

Perspectives on Unique Water-Agriculture Policy

Water scarcity can be defined as a period when water demands exceed water availability and people find that their lives and livelihoods are constrained by water shortages (Murtinho, 2013, p. 668). An important point to note, in this definition, is that water scarcity, or a drought, is not necessarily a meteorological condition where there is little or no precipitation. Each discreet paradigm can present a set of issues which are wholly their own. This is evident as demand for water is socially and culturally constructed, depending on the kind of economy in place, the kind of environment present, etc. Thus, each may require a different set of methods to ensure adequate water of a necessary quality to be useful to humanity.

Each location has a unique perspective with respect to water issues. These range from an existing condition of insufficient water supply, because of significant reduction in local precipitation, to the expectation of future issues which might arise. Issues which were not addressed in these, but are potentially present as well, regard that of too much water leading to floods, or contamination of sources, which are additional subjects requiring research. This is a picture of much of the world; on the one hand there are those dealing with water scarcity and on the other, those who are anticipating such an event.

Sao Paulo, Brazil.

Since 1934 the authorities in Sao Paulo, Brazil have been aware of the prospect of an issue with providing adequate water for their growing metropolis. There have been efforts to engage policies and processes which were intended to meet the needs of flourishing agriculture and industry. However, the results have been less than satisfactory as three drought events have each left the city with a temporary shortage of water (Johnsson & Kemper, 2005, p. 13).

Drummond and Barros-Platiau (2006) each collected and analyzed data from selected environmental laws and policies enacted by the federal government of Brazil from 1934 to 2002. The results of their work were originally published as a master thesis (1998) and doctoral dissertation (2000), respectively. The paper published by the Baldy Center for Law and Social Policy combined and refined the findings of Drummond and Barros-Platiau highlighting the significant efforts regarding water management.

The "Water and Mines Code" (a popular name for Presidential Decree 24.643) was enacted in July of 1934. In conjunction with this, the forest management code was also decreed. These decrees were a milestone in Brazilian environmental law, the main effect of which was to place all public lands under the control of federal agencies. Up to this time these resources had been under the control of private interests. This system was not unlike the "law of the jungle" in that the most powerful entity exercised control over as much land and its resources as possible. Through a concession system, established under the Water and Mines Code, companies were licensed to use the land resources. Private, state-owned and hybrid entities developed hydroelectric systems and expanded agricultural use (Drummond & Barros-Platiau 2006, p. 87).

The "Forest Code", enacted in January of the same year, mainly dealt with control of logging. However, there was some provision for protecting some classes of forest land. Unfortunately, the sections that provided protection of the watershed were not included among those granted "permanent protection". The enforcement of this "protection" was only lightly implemented, and then only where there was easy access to the area and the inspection effort was less difficult. Though the initiative was groundbreaking, in practice the 1934 decrees lacked specific attention to the problem of providing a domestic water supply (Drummond & Barros-Platiau 2006, p. 89).

The next significant effort came because of the "Land Statute", enacted in November of 1964. The intervening years saw little additional movement toward management of natural resources due to a global depression and World War II. A 1964 military coup, that ousted the civilian government, enacted a progressive land reform law, which made it legal for the government to seize private land deemed to have "full social function". This revolutionary concept made wasteful land use illegal, while making protection of the environment public policy (Drummond & Barros-Platiau 2006, p. 89). Despite all these efforts, a specific provision of adequate clean water for the general population was still not considered a point of necessity. In fact, these decrees appeared to primarily benefit wealthy individuals and corporate interests.

In June of 2005 Rosa Maria Formiga Johnsson and Karin Erika Kemper completed research, funded by the World Bank. The working title of their paper was “Integrated River Basin Management and the Principle of Managing Water Resources at the Lowest Appropriate Level – When and Why Does It (Not) Work in Practice?”. The research findings were published as a World Bank Policy Research Working Paper entitled

Institutional and policy analysis of river basin management: The Alto-Tiete river basin, Sao Paulo, Brazil.

Johnsson and Kemper (2005) state that Brazil had begun to define and implement water resource management systems earlier than other countries. The resource management system put into practice was based on the principles espoused by various prominent global charters. A major element of these principles embraced the concept of localized policies and decentralization of authority regarding the management of water resources.

In 1991 Sao Paulo was the first state to codify these principles. It was expected that São Paulo state would achieve advances in decentralized water resources management (Johnsson & Kemper, 2005, p. 4). Being the richest and best-equipped as well as having the most-experienced water management institutions, the state of Sao Paulo was able to take the first steps towards implementation with no federal assistance. However, the process of increasing the scale of implementation was more difficult. Due to the excessive amount of industrial development and the increase in the urban population (in the focus area of the 2005 study) the execution of localized control was hampered (Johnsson & Kemper, 2005, p. 5). It was determined that the tactics employed must consider the hydrologicaly, socio-economic, cultural and historical aspects of the indigenous population of the local area (Johnsson, et al, 2005, p. 5).

In 2005 the term “basin-level” was introduced to describe the context of the local area (Johnsson & Kemper, 2005, pp. 5-6). This is a reference to the specific region that was the focus of their research, The Alto-Tietê River Basin, in São Paulo, Brazil. However, the term is appropriate for virtually any other locality since the supply of water to most regions will generally equate to a river basin.

Specific attributes are further defined to consider when engaging the process of decentralization: Economic development of the nation, Economic development of the basin area, Initial distribution of resources among basin stakeholders; and Class, religious, or other social/cultural distinctions among basin stakeholders (Johnsson & Kemper, 2005, pp. 5-6). The case of the Alto-Tietê River Basin, and therefore that of the São Paulo metropolitan area, historically had positive marks for the first two elements. However, the third had only included industrial and large agricultural entities without consideration for small farms or the general population (Johnsson & Kemper, 2005).

In addition, there is no indication that the fourth marks were factors considered in the early efforts to implement water management processes. The exceptions would be that the upper class might have benefited from the industrial and major agricultural uses. By the time of the research of Johnsson & Kemper, the provision to the urban population had finally become a concern and was therefore an additional consideration in the process of water management (Johnsson & Kemper, 2005, p. 9).

An issue which arose was uncontrolled groundwater use, as a result of urban sprawl being unregulated (Johnsson & Kemper 2005, pp. 8, 11-12). This was exacerbated by the continued hegemony of the influential hydropower sector conflicting with the need of drinking water for the Sao Paulo metropolitan area. An additional complicating factor was the lack of adequate sewage collection and treatment facilities and improper disposal of solid waste. This lack lead to contamination of the little water that was available. Each of the issues had some form of legislative direction which was intended to deal with the issue. However, they each lacked complimentary regulation to make the laws operational (Johnsson & Kemper, 2005, p. 12).

The structure of the organization developed for the purpose of water management in the Alto-Tietê River Basin, consisted of as many as 14 separate federal, state and municipal agencies. The relationships between these entities is a complex arrangement and the processes engaged to affect water management entailed a series of dynamic bargaining protocols. The net result was (as of 2006) the establishment of what is essentially a symbolic organization which consisted of a small office with a three-person technical team (Johnsson & Kemper, 2005, p. 21).

A major drought was experienced in Brazil late in 2000 which carried into 2001. The drought eventually leads to a declaration of a national level energy crisis due to insufficient water supply for hydropower systems (Johnsson & Kemper, 2005, p. 13). This impact was also felt by the urban population. However, Johnsson & Kemper do not mention the issue of human suffering. The meteorological mechanisms at work during this event were not unheard of in the region, though rarely experienced to this degree (Cavalcanti & Kousky, 2001, p. 2).

Since December 2013/January 2014 (the normal rainy season for the Southern Hemisphere) the region, which includes Sao Paulo has been experiencing the meteorological anomaly which has previously brought about the drought conditions (Escobar, 2015). This dearth, now in its fifth year, has led to a severe shortage of water throughout the Sao Paulo metropolitan area. The local governments are attempting to curtail excessive use and waste by financially rewarding those who conserve and punishing those who do not by levying a fine. In addition, the pressure of the water main has been reduced to minimize leakage rates and discourage waste. It is being contemplated by the several local governments to take

drastic measures in the form of a complete shutdown of the water distribution system for hours or days at a time.

The Alto-Tiete river basin water system, as of 2015, had only 15% of its volume remaining (Escobar, 2015). Reservoirs in adjacent regions were also at low volumes. A new system was being constructed to bring in water from a distant watershed but was not expected to be completed until 2016. The impending dry season of 2015 had already impacted the region, leaving the expectation of what could have been a human tragedy of epic proportions.

Escobar (2015) cites unnamed Brazilian scientists (with expertise in water issues) as blaming a combination of the effects of the current climate anomaly and the ineffective government programs for the growing crisis. They further stated that there is a need to be prepared for increasingly extreme climate events.

The early effort of water management was oriented to industrial and major agricultural uses. The tendency to cater to the desires of the affluent had the potential of resulting in mismanagement (Johnsson & Kemper, 2005, pp. 8, 11-12). Due to low-income residents being continually expelled from the urban centers the city's periphery became shantytowns for the poor (Johnsson & Kemper, 2005, p. 8). Mismanagement of water resources combined with uncontrolled urban sprawl set the context for a potential disaster (Johnsson & Kemper 2005, pp. 8, 11-12).

The ingredient which has completed this recipe for disaster is unfortunately mostly beyond the control of any human being. Climate variability, whether of anthropogenic origin or a completely natural cycle, is the element which is the catalyst for an unexpected event. Yet these events are not unknown.

Based upon historical documentation and the geological record, humanity is very much aware of many potential climatic events. With these we may plan for each as much as it is possible relative to the risk of the event and the potential lost.

Brazil has significant water resources available on a national level. The Amazon is responsible for about 20% of the Earth's fresh water entering the oceans. The river pushes a vast plume of fresh water into the ocean. The plume is about 250 miles long and between 62 and 124 miles wide (Penn, 2001, p. 8). The river basins, lakes and reservoirs which make up the Sao Paulo metropolitan area water supply system do not compare to the Amazon. But the water supply is adequate to the needs of the population.

The referenced data lead one to conclude that the issue which lead to the crisis is mainly a lack of adequate management. This applies to the domestic housing, sewage collection and disposal/processing, solid waste collection and disposal, as well as the equitable division of water resources. Each of these had some form of legislative effort to administer and control at various levels. However, the lack of operational regulations each law had little or no effect. Despite the long history of water related policy development and implementation the efforts to date have created what appears to be a bureaucratic system that does not return on the investment of time and resources. Goleta can learn from the experience of Sao Paolo by adjusting policy to be more oriented to the general population rather than a small minority of affluent residents. After more than eighty years of "water management" the metropolitan area of Sao Paolo fringe population suffers from a lack of adequate public resources, including water.

Syros Island, Greece.

Unlike the region of Sao Paolo, Brazil, the island of Syros is not concerned with an increasing population. The issue being that there are regular periods of water scarcity that need to be addressed. The municipal leadership has utilized the concepts of risk management to aid in addressing the issue.

Syros Island is in the Greek Cyclades complex, south of the Aegean Sea. With an archetypal Mediterranean climate, it has relatively low annual precipitation. In an attempt to mitigate the impact of the occasional water scarcity events, a system of drought-related risk estimation was defined. This risk analysis provided an approximation of the effects of various mitigation options (Giannikopoulou, et al, 2017, p. 655).

Domestic use takes a back seat because much of that comes from desalination. Since the main effect of droughts is on the agricultural efforts in Syros, the risk management framework focuses on that impact. Toward this end various drought mitigation options were identified: rainwater harvesting for domestic use, rainwater harvesting for irrigation, wastewater recycling for irrigation, increase of desalination capacity to meet peak demand, artificial aquifer recharge, crop substitution to more drought resilient ones

A process for the risk-based assessment of drought mitigation options is proposed, which involves three steps, starting from future hazard analysis and concluding with a comparative analysis of potential mitigation options: Risk identification. Drought conditions are analyzed in terms of magnitude (severity), duration and frequency (probability of occurrence and return period), on the basis of climate projections, Risk assessment regarding anticipated impacts. Impacts are quantified in monetary terms, for the different drought severity levels, and then aggregated to estimate the total risk of economic losses and Risk management, through measures for dealing with drought and minimizing risk to an

acceptable level. Water balance modelling is used to assess the effect of measures on drought mitigation, whereas measures are compared and ranked on the basis of three criteria: risk, vulnerability and cost-benefit ratio (Giannikopoulou, et al, 2017, p. 663).

Risk based management efforts ensure that the higher priority uses are targeted with respect to their vulnerabilities and the mitigating actions. This management paradigm is ideal for focusing on the "return on investment" and generally minimizes wasted efforts and assets. As with any situation, it is reasonable to consider all vulnerabilities. Goleta has issues which present certain risks of occurrence which would impact the ability of the Goleta Water District to adequately provide for their customers in general.

The risk of a water shortage emergency, if realized, present additional risks of including inadequate produce from the agriculture community which in the worst-case scenario might lead to a famine. At the very least the impact could be individual farmers being unable to continue their operations. This would, in some cases cause a family to lose their source of income but might lead to their financial ruin.

Sana'a Basin, Yemen.

Conditions in the Sana'a Basin have generally been adequate with respect to providing irrigation for agriculture and potable water for the population. However, the increased migration to the city from the rural areas is expected to impact the future demands.

The Sana'a Basin is located at the eastern end of the western highland of Yemen, at the southern end of the Arabian Peninsula. The population of the basin, as of 2015, was 3,517,225. The anticipated increase, based upon a ten-year estimate, is expected to nearly reach six million by 2025. This growth is expected to cause water demand to exceed the supply provided by the local rainfall (Taher, 2016, p. 1595).

Overexploitation has caused a shortage of water of adequate quality. Abstraction has been five times higher than recharge resulting in water table levels to decrease by four to eight meters per year. The situation has been exacerbated by a lack of suitable water management methods (Taher, 2016, p. 1593). Efforts to address the issue include reducing the number of wells drawing on the aquafer and/or decreasing the number of hours of well operation. In addition, since agricultural usage accounts for about 90% of the total water use, more efficient irrigation methods for that community were recommended (Taher, 2016, p. 1593). This forward thinking is an absolute necessity for any reality which has an element of uncertainty. With climate change guaranteeing an unpredictable state of the major water sources supply could easily fall short of the burgeoning demand of a growing population.

Fúquene watershed, Eastern Andes of Colombia.

This case brings into focus the need for cooperation between various local bodies. The watershed feeds several localities such that any solution to the potential for water scarcity impacts must be amenable to all stakeholders.

The Fúquene watershed is in the northern part of the eastern mountain range of the Andes, about 60 miles north of Bogotá. Elevations range from 7875 feet, where the lake Laguna De Fúquene is located, to 12,300, in the surrounding mountains. Global climate models indicate that the expected rainfall, local to the Andes, will be widely variable. Consequently, it is anticipated that there will be a greater frequency of water scarcity periods (Murtinho, et al, 2013, p. 667).

The projected water scarcity has mobilized various entities intent upon preparing the respective communities for the eventuality. Government at all levels are working with non-

government organization (NGO) to enable the local water users to engage with the local management systems and public utilities to this end (Murtinho, et al, 2013, p. 667).

The issue appears to be one of a lack of education of the interested parties with respect to the realities of water scarcity. Perception of the causes and consequences, by the water users, is ill-defined. The desire of the NGO and government cooperative is to assess the level of knowledge and educate as necessary to improve efforts to reduce water use while innovating to increase crop yields.

Major water users being unaware of issues regarding water scarcity would threaten to bring about a cascading social casualty. Misuse and waste might lead to loss of a crop which in the worst-case scenario could lead to a local famine like condition. Thus, enhances understand on the part of the agricultural community regarding drought causes and consequences is imperative.

Composite analysis.

The situational vectors which results in a state of water scarcity consist of more than just a lack of precipitation. In the case of Sao Paulo, there has been a situation where water was available but not of a level of quality that would be sufficient for human uses. Whereas, in Yemen, the condition of water scarcity is a future probability due to the estimated imminent increase in population. Some of the causes of a condition of water scarcity can be anticipated while others happen only with a minimal level of regularity or forewarning. However, the consequences are well known and can be dire for those impacted.

No matter the location or exact circumstance a combination of the efforts in each instance would likely achieve satisfactory results. Thus, any entity tasked with ensuring adequate water for a user base could adhere to the following: The major water users need to

acquire a proper perspective regarding drought causes and consequences. To this end public information sessions could be regularly scheduled, a thorough risk program could be implemented to identify specific vulnerabilities, risks for each and potential mitigating actions, alternative water sources could be developed to supplement existing sources, regulatory policy should allocate using a doctrine of fairness where available resources are shared according to a reasonable method of apportionment, contingency plans should be developed to address shortage events, legislation must have attendant regulations, management must be objective in discharge of legal obligations and water should be managed as a pure common-pool resource (CPR) and not a marketable commodity (Cleveland, 2014, p. 297).

In any event, it should never be assumed that a location or region will always have enough water. Many of the factors that contribute to the main issue of water scarcity are well known and constitute the sciences of meteorology and climatology. However, the myriad possible impacting elements of the planet, solar system, galaxy and the reality we know as the universe are currently quite beyond the full understanding of humanity. Therefore, it is crucial that policy makers take this element of uncertainty seriously when defining the requirements that will ultimately generate expenditures of revenue.

Water issues and the management thereof eventually lead to the end user by way of the policy document. The various specific communities either enjoy or endure the implementation of these edicts. However, the agricultural user community is likely to suffer most when these guidelines are implemented in a condition of water scarcity.

Key words and phrases that tell the aggregate story of these diverse circumstances regarding domestic housing, sewage collection and disposal/processing, solid waste collection and disposal.

Issues.

Major water users ignorant, social casualty, Misuse and waste, lack of adequate management, lack of operational regulations, reducing demand arbitrarily

Effect.

the metropolitan area fringe population suffers from a lack of adequate public resources, risk of a water shortage, additional risks, inadequate produce, farmers unable to continue operations, Farmer family to lose their source of income, their financial ruin

Solutions.

efficient irrigation methods, forward thinking is an absolute necessity for any reality which has an element of uncertainty

CHAPTER THREE: EMPLOYED METHODS

Research Questions

What stories do small-scale family farmers, who purchase their irrigation water from the Goleta Water District, tell of the challenges, policies, and issues during conditions of water shortage?

How would the small-scale farmer describe the impact of applicable policies, as implemented by the Goleta Water District Board, which deal with Goleta's water shortage challenges?

Coherent Approach

To answer this twofold query calls for the expression of emotions and airing of complaints as well as any commendation. The subject farmer must be seen as the unique individual whose core being drives him or her to labor against nature daily as virtually all the forebears of humanity once did. This context can only be addressed from a qualitative standpoint. To gain this level of understanding would require joining in the life of the subject as a fully ethnographic study. As this was not feasible, the approach was as a case study using ethnographic methods. Interviews were conducted as close to the fields/orchards as each participant allowed.

Narrative of Method

The process of research followed the principles of ethnography; that is, this research discovered the individual and community mindset or philosophy, common beliefs and behaviors of the Goleta small-scale, family farmer. The intention was to understand the experiences of the various small-scale crop family farmers during the recent drought, as well as any other period of water scarcity. This was expressed as individual narratives from the

very people who had lived and are even now living the experiences. This study explored the lived experience of belonging to this small but vital group within the local community. Amongst the general population this minority group shares a specific resource but the extent to which they rely on it is much greater, in that their livelihood depends upon it.

An ethnographic methodology was employed in this case study to investigate the unique condition typifying this social category. It was the ideal methodology since this is a peculiar group compared to most water customers. Individual interviews were used to gather data and investigate the lived-experience complexities of the human system, and underlying group process at work, whether within the immediate/extended family or extrafamilial organization (Sánchez-Jankowski, 2018).

Though I have roots in the agricultural community and a growing sense of direct personal impact, yet to maintain an emotional distance a phenomenological methodology was not pursued. During the research for this current work, emotional and social separation was maintained, though there was comity with the subject families. For the period of observation, objectivity was necessary. Still, the subject, in this study, was much more than something to be observed. The research interviews were conducted at the place of the individual or family employ; the family property, that is worked to produce their given crop, which is also their home.

The individual farming families were selected from a variety of sources. First local and area farmers markets will be canvassed, and prospects identified. Also, the local agricultural commission provided names and contact information of agricultural entities which used certain chemicals in their processes. These locations are certified by the county through a rigorous qualification standard to transport, store and apply the insecticides and

fertilizers in question. From this list, a group was selected which meets the requirements defined by the United States Department of Agricultural. The classification of agricultural entities is based upon a value which the United States Department of Agricultural calls the Gross Cash Farm Income. The definition of the Small family farm is one which the is Gross Cash Farm Income less than $350,000 per year (USDA 2015, p. iii). This value was recently changed from the gross revenues as well as the amount increased from $250,000 (MacDonald, et al, 2013, p. 7).

Of the users who have the one hundred sixty-six agricultural connections to the Goleta Water District the intent was to interview at least five who meet the requirements of a small-scale family farm. The selection process consisted of a vetting process beginning with face to face canvassing at local farmers markets. This effort did not produce the required number and quality of prospects such that a direct mail effort to the mailing list derived from the Santa Barbara California County Agricultural Commission was implemented. Most of the potential subjects were not focused on crop farming, but consisted of golf courses, apartment complexes and nurseries. The crop farmers were the sub-group that was considered. Of these it is estimated that no more than twenty-five would qualify as small-scale operations. No official accounting of this is available from any authoritative source.

In addition to the small-scale farmers, the members of the Goleta Water Board were asked to participate in the interview protocol. The series of questions included in the protocol are derived from that of Burnham, et al (2016). Two separate protocols (Appendix A and B) were developed for the respective subject. In anticipation, one could only guess what the small-scale farmer's experience might have entailed. It seemed logical that these would have suffered through such a period; but their subjective experience expressed in their

words, with their tone of voice and body language informed a theoretical framework (Auerbach & Silverstein, 2003, p. 7).

In addition, the five directors of the Goleta Water District board were asked to be interviewed using a separate but similar protocol from that used for the farmers. When none made themselves available, I made a public appeal during a monthly board meeting. The General Manager volunteered with the consent of the General Counsel to engage in the research but all attempts to contact received no reply.

Though the reality of anthropogenic climate change is deemed a settled fact of science (Oreskes, 2004), yet in this paradigm it is considered independent since the impact of the small-scale farmer would be minimal when considered by itself.

Participant standards.

Urban small-scale crop farmers

Method: Qualitative; though there are some numerical values specified by the subjects the intent was to draw out the lived experience from a human perspective as opposed to engaging in an accounting exercise.

Methodology: Ethnographic case study: the subjects were a specific and peculiar group engaging in urban agriculture.

What: Interview; preferably a personal face to face context to prompt a visceral response.

Data sources: Participant interviews: each interview was recorded and the recording transcribed.

Whom: Family farms

Number of participants: 5 to 7 farmers

Where: Local farms

Selection criteria for participants: Small-scale USDA definition and family operated with a connection to Goleta Water District

When: At the convenience of the farmer

Setting: Field, orchard or what is most convenient for the participant

How long: 60 minutes

Goleta Water District Board of Directors

The intent was to give the Goleta Water District an opportunity to explain the complexities of policy definition and implementation regarding a condition of water scarcity.

Method: Qualitative. Though it was likely there would be some numerical value specified by the subjects the intent was to draw out the lived experience in a human

Methodology: Ethnographic narrative. The subjects were a specific and peculiar group elected to the Goleta Water District board of directors. They were the public face of the Goleta Water District.

What: interview. A personal face to face context to prompt a visceral response.

Data sources: Participant interviews. Each interview was to be recorded and the recording transcribed.

Whom: Goleta Water District

Number of participants: 1 or 2 Directors

Where: Goleta Water District

Selection criteria for participants: Elected or appointed member of the Goleta Water District board of directors

When: At the convenience of the director

Setting: Office or what is most convenient for the participant

How long: 60 minutes

Coding and Analysis

Coding was a variable result of the interviewee's words as recorded and transcribed as well as field notes of non-verbal communication. This is since the qualitative methodology is about the voice of the participants (Auerbach & Silverstein, 2003, p. 126). Shades of meaning were identified in each narrative to produce salient themes. Ad hoc real-time alterations to the verbiage of the protocols were necessary as varying language skills were encountered.

Labeling of each location was accomplished in a manner that protects the identity and privacy of the participants. Each was identified using the name of a farm or ranch which has appeared in a television show or movie, such as Ponderosa, Little House, South Fork, et al. The relationship between each actual location and the pseudonym is known only to the me.

Pilot Study; Policy Document Analysis

The pilot study entailed assembly of all applicable policy documents extant. Each was analyzed to derive the impact on the local small-scale family farmers who derive their irrigation water mainly from the Goleta Water District. This treatment was intended to articulate the paradigm of multiple intersecting human and organizational systems.

Though the application of general systems theory to the development, implementation and administration of policy was thought to provide a crucial conceptual structure (Dror, 1969, p. 2). The unresolved issue was that of the confusion over what exactly constituted a policy (Guba, 1984, p. 63). A difference in definition between the writer and the

reader/implementer of the term could make it irrelevant or worse yet destructive (Guba, 1984, p. 64). Dror considered the then application of social sciences from a systems perspective as little better than the advice of a seer or shaman (Dror, 1969, p. 4).

Fortunately, those who would follow in the footsteps of Dror have furthered the science of policy analysis. Guba began to develop a systematic framework by which to devise and analyze policy. The first element was termed the "policy type". This would indicate proximity to the point of action of a directive; that is, the intention, action or experience.

The next element would be the "policy determiner". This would be the individual or body which exercised authority in the matters impacted by the specific policy, the functionary who fleshes out the details of the policy or the client who experiences the implementation (Guba, 1984, p. 65).

The "definition of policy" is the central point of Guba's matrix, giving substance to policy intent, thus: Goals or intents, standing decisions, guide to discretionary actions, and so forth. Guba further identifies such elements as the proximity to point of action and what the policy looks like. Together this matrix informs a process for defining and interpreting policy statements. Though the exemplar areas specified by Guba hold sway over different areas than the issues within the pale of the Goleta Water District, yet, the matrices and processes can be easily applied thereon (Guba, 1984, p. 65).

Further maturation of systems thinking applied to policy development and analysis can be seen in the work of Bardach (2012). The "eightfold path" contains steps which, though not always required, are often necessary for an adequate treatment of an issue from a policy definition/implementation/interpretation perspective. Bardach's eight-fold path is well

suited to apply this philosophy. The steps can be accomplished in any order though a basic definition of the issue at hand is the most logical point of departure. The steps: Define the Problem, Assemble Some Evidence, Construct the Alternatives, Select the Criteria, Project the Outcomes, Confront the Trade-offs, Decide and Tell Your Story (Bardach, 2012, p. xvi).

Two issues with the ideas of Bardach which might be of concern to the social scientist in the process of composing a policy, is that the process depends upon intuition as much as it does a graven-in-stone method. Also, it assumes that the process will entail trial and error and that the attitude of the participants might well be somewhat hesitant (Bardach, 2012, p.xvii). Yet in the midst of this sense of indecision there are usually some steps which will appear as predetermined.

Although the ideal employment of this method is to deal with an issue by defining a specific policy it is also useful in "reverse engineering" the process to fully appreciate an existing policy and ensure proper application at the client level. With respect to the issue at hand the matrices of Guba might be used to orient the analysis in this case the policy question leads us to the clients, the local small-scale farmers, to seek their feeling with regard to the various policies of the Goleta Water District. Addressing the policies extant from the perspective of the client farmer entailed identification and classification of the customer community.

Water policy in larger contexts: global and national.

The United Nations has been the source of many documents espousing environmental causes, and calls to action, in favor of various ecological conservation efforts. Few if any of these amount to binding policies for the signatories, even if the respective national governments ratify the document.

With each treaty where the USA is a signatory, generally the following statement is appended thereto: "The United States hereby declares, pursuant to Article 30, paragraph 5, that any amendment to an annex to the Convention shall enter into force for the United States only upon the deposit of its instrument of ratification, acceptance, approval, or accession with respect thereto". Thus, for the most part very few dictates of the global community have become policy applicable to any water district within the USA.

In addition, the United Nations engages the process of coordinating the various efforts of UN work on water issues and sanitation through the UN-Water organization. UN-Water's Policy Briefs provide short and informative analyses on issues that draw upon the combined expertise of the United Nations System (UN-Water, 2017). They are the UN's joint position in the subject in question, but do not have the effect of a policy (Tamara Slowik, UN-Water Technical Advisory Unit, personal communication, July 26, 2017).

The United States Federal Government (USG) executive branch defines policy based upon legislative documents signed into law by the President of the United States (POTUS). Two recent major documents were the Federal Water Pollution Control Act, of November 27, 2002 and the Safe Drinking Water Act of December 31, 2002.

The U.S. Code › Title 43 § 661 through 666, include codes which apply to water in general and "public" water in particular. These deal with appropriation on public lands, rights of way for canals and ditches, Reservation of reservoir sites generally, and others.

Though these documents certainly are applicable to the location where much the customer base of Goleta Water District resides, the specific codes are largely at a level where they do not directly impact the intended subject of this research.

Water policy at the local level: state, county, and city.

The State of California water policies reach back to the days of the Spanish conquest. Previous to this era the indigenousness tribes rarely had any significant issues since their population size did not impose a demand on the natural water flows that exceeded its capacity.

The Spanish Conquistadores essentially came in and claimed the area as belonging to their then current royalty, defining the water as property of the kingdom. Water from that perspective was considered to be available to all for private uses. When land was granted to an individual or family, the water rights also only applied to domestic use (Apple 2001, pp. 3-4). When California was ceded to the United States by Mexico through the Treaty of Guadalupe-Hidalgo there was no US based governing body nor codified policies regarding property or water rights (Apple 2001, pp. 6-7).

Present day water policy at the state level falls under the auspices of the California Environmental Protection Agency (California Environmental Protection Agency, 1991). The State Water Resources Control Board (SWRCB), an office under the California Environmental Protection Agency (CalEPA), operates via regional boards. The Goleta Water District falls under the Regional Water Quality Control Board, Central Coast Region. The Water Quality Control Plan for the Central Coastal Basin (Central Coast Regional Water Board, 2012) constitutes the primary policy document applicable to the Goleta Water District from state level authority.

The county of Santa Barbara policy authority is the Water Resource Division (SBWRD) of the Department of Public Works. The SBWRD consists of two separate dependent districts: the Santa Barbara County Flood Control and Water Conservation District (FCD) and the County Water Agency (SBWA; Boelhouwer 2017). The SBWA was

established by the state legislature in 1945 to control and conserve storm, flood and other surface waters for beneficial use and to enter into contracts for water supply. The FCD was created in 1955 by the State legislature because of severe flooding and damage resulting from storms in the early 1950s. The purpose of the FCD was to provide protection from flooding and aid in conservation of storm and flood waters for public use.

In 1994, after a succession of county reorganizations, the County Water Agency and the Flood Control District were combined to form the new Water Resources Division of the Public Works Department (Santa Barbara County - Flood Control District, 2016). The primary policy document issued by the County of Santa Barbara is the Integrated Regional Water Management Program (Santa Barbara Water Resources, 2013).

The Goleta Water District came into existence in November of 1944 as a subdivision of the State of California Water Code. At the time, the region was in the midst of a severe drought just as it was recently. Since then the area has experienced droughts during the periods of 1959 to 1962, 1976 to 1977, 1987 to 1992, 2007 to 2009, and the recent episode beginning in 2012 and ending in 2019.

The Goleta Water District infrastructure consists of coverage for 16,600 municipal and industrial customer accounts and 165 agricultural accounts. The District is entitled to 36.25% of Lake Cachuma's available supply; 9,322 acre-feet per year. The Goleta Water District piping is connected to the State Water Project by a 143-mile pipeline, treatment plant and other facilities. The District plans to be able to receive approximately 3,800 acre-feet per year from the State Water Project during normal conditions. Goleta Water District's nine wells can produce about 5,000 acre-feet of groundwater per year, when certain conditions are met (Goleta Water District, 2020a).

The Goleta Water District management consists of a board of five members (known as directors), elected by the residents of the City of Goleta, and a professional staff (Goleta Water District, 2017, January). The professional staff is led by the General Manager and an Assistant General Manager, who serves as the Chief of Staff. The board acts as a legislative body while the professional staff acts as an executive element; the General Manager serving in the capacity of a chief executive. Board member elections occur during the general and midterm election and are seated for four years.

This area is generally described as having a "warm-summer Mediterranean" climate (Kesseli, 1942, p. 3). Yet it has experienced severe droughts regularly, at least since 101 BCE, at a rate of 4.5/100 years (Hughes & Brown, 1992). Thus, the Goleta Water District, in concert with the California Department of Water Resources, and in conjunction with the various members of the Association of California Water Agencies, have developed standards to define what constitutes a drought and what actions or user restrictions are implemented and which particular points.

The Goleta Water District has established five water shortage stages each with specific triggers and use reduction objectives (Kennedy/Jenks Consultants, 2010). The implementation of each stage is dependent upon three basic criteria: The reduction in available water sources relative to the normal expected demand for the next twelve months. The ability to provide a specific percentage of deliveries over the next twenty-four month and Contamination of water supply (Goleta Water District, 2014, July, pp. 5-2 through 5-13).

Stage	Supply Shortage Condition (If any of the following occur)	System-wide Reduction Target	Demand Reduction Measures
I	-District water supply is 85 to 90% of normal (10-15% supply deficiency) for the next twelve months. -District water supply is insufficient to provide 80% of normal deliveries for the next twenty-four months. -Contamination of 10% of water supply (pollutant exceeds primary drinking water standards)	15%	Voluntary water use reductions
II	-District water supply is 75 to 85% of normal (16-25% supply deficiency) for the next twelve months. -District water supply is insufficient to provide 75% of normal deliveries for the next twenty-four months. -Contamination of 20% of water supply (pollutant exceeds primary drinking water standards)	25%	Mandatory: limits and prohibitions on certain uses
III	-District water supply is 65 to 75% of normal (26-35% supply deficiency) for the next twelve months. -District water supply is insufficient to provide 65% of normal deliveries for the next twenty-four months. -Contamination of 30% of water supply (pollutant exceeds primary drinking water standards)	35%	Same as Stage II, but more severe Potential drought rates
IV	-District water supply is 55 to 65% of normal (36-45% supply deficiency) for the next twelve months. -District water supply is insufficient to provide 55% of normal deliveries for the next twenty-four months. -Contamination of 40% of water supply (pollutant exceeds primary drinking water standards)	45%	Same as Stage III, but more severe

Stage	Supply Shortage Condition (If any of the following occur)	System-wide Reduction Target	Demand Reduction Measures
V	-District water supply is less than 55% of normal (46% or higher supply deficiency) for the next twelve months. -District water supply is insufficient to provide 50% of normal deliveries for the next twenty-four months. -Contamination of 50% or more of water supply (pollutant exceeds primary drinking water standards) -Unanticipated loss of water distribution or supply facilities due to disaster or man-made emergencies	50% or greater	Same as Stages III & IV, but more severe

Thus, a water shortage is not only possible as a result of a naturally occurring drought but also due to pollution of the various water sources. In theory, a drought condition could also be caused by an increase in population without an increase in water supply.

Each water shortage stage includes four basic areas of effort. The individual elements of each in some cases are Public Outreach Plan, Demand Reduction Programs, Enforcement and Other Operational Actions (Goleta Water District, 2014, July, pp. 5-2 through 5-4).

The Public outreach plan includes a press release following the Board Declaration of a Stage I water shortage emergency. A media kit is developed to define the talking points for media interviews and inquiries. The District Newsletter (a standard monthly periodical) will include Water Supply Story, General Manager's Message, and Water Conservation Tips.

The District website will be updated with sections covering conservation tools and tips for customers. Billing statement will include conservation messages. Coordination with regional and statewide partners on messaging and outreach. Development and utilization of customized state and regional partner outreach materials and links (saveourh20, ACWA,

waterwisesb, etc.). Outreach at community events (i.e., the Santa Barbara Home and Garden Expo, Santa Barbara Association of Realtors workshop, school fairs and programs, workshop with landscaping professionals, etc.). Outreach to hotels and restaurants to establish opportunities for customers to request daily washing of linens and water for the table, respectively.

District employee outreach and education to promote consistent organizational messages related to water supply and conservation (Goleta Water District, 2014, July, pp. 5-2 & 5-3). Demand Reduction Programs implement accelerate audit and incentive programs for agriculture, large customers, and irrigation accounts. Identification of largest water users in each sector and contact them for complementary water audits. Identification and notification of customers for possible leaks. Encouraging use of drip irrigation and drought tolerant plants. The enforcement of water theft prohibition (Goleta Water District, 2014, July, p. 5-3).

Enforcement can go as far as what is sometimes referred to as “water cops” patrolling neighborhoods, but at least requires active enforcement of water waste prohibition (District Code 6.20.070) and setting up a water conservation hotline to allow customers to report water waste and leaks. Customers found to be in violation will be issued a written warning and may be subject to a fine as authorized by the District Code 6.20.110 (Goleta Water District, 2014, pp. 5-3 & 5-4).

Other Operational Actions are taken by the Goleta Water District board and professional staff including supplier efficiency actions, examining district facilities, water fixtures, and landscaping for efficiency and identify any areas for improvement. Reduction of

water usage for main flushing, street flushing, and hydrant flushing (Goleta Water District, 2014, July, p. 5-4).

At Stage II, the District did not impose mandatory irrigation restrictions or demand reductions on agricultural customers. Stage III implementation included restrictions on the use of overhead sprinklers on outdoor commercial crops and orchards. Outdoor crops and orchards irrigated with overhead sprinklers could be watered before 10:00 A.M. and after 4:00 p.m. This would not apply to the use of drip or micro-spray irrigation, or irrigation of indoor greenhouses.

The Goleta Water District board meets monthly. In this public venue, proposed policy changes are presented and considered by its members. Changes may be recommended by the Goleta Water District professional staff as well as by the customer community. Prior to their introduction, proposals are reviewed by respective committees consisting of one or more members of the board and professional staff. The respective committee may recommend acceptance or rejection.

A local municipal agency is the ideal entity to observe democracy in as pure an application as can be found in a nation as large as the United States. The Goleta Water District, in effect a microscopic democratic state, is an implementation of democracy. Boundaries of its power are delineated by international, federal and state policies but within these limits the Goleta Water District and its constituents operate as a democratic state with respect to water issues.

The foundational body of policy documents rests upon the Goleta Water District Code (Goleta Water District, 2006), with the latest revision being completed and approved in 2019 (Goleta Water District, 2019). In addition, the district also adheres to the Goleta Water

District Water Supply Management Plan (Goleta Water District, 2017, May), the Urban Water Management Plan, updated in 2010 (Kennedy/Jenks Consultants, 2010) and the Ground Water Management Plan, updated in 2017 (Goleta Water District (2017, May). These documents distill the voluminous regulatory and advisory documents that flow down to the district from the international, federal, state and county agencies.

From the policy documents, the Goleta Water District board and professional staff developed and implemented various policy documents to address specific issues. These include regulations applied when a drought is declared. The Goleta Water District Drought Preparedness and Water Shortage Contingency Plan (Kennedy/Jenks Consultants, 2014, pp. 5-1) stipulates explicit "triggers" for each of five stages of a water shortage emergency. The actions required for each stage included elements of public outreach, demand reduction, enforcement, and other operational efforts (Goleta Water District, 2014, July, pp. 4-1).

The tactics, techniques, and procedures defined by the board and employed by the professional staff of the Goleta Water District are subject to change based upon input from the customer base, the staff and the board. It is also possible to act upon recommendations from external sources such as state, federal or international agencies or input from scholarly research results.

A recent case in point was as a result of the watering restrictions which would be implemented if the board were to declare a Stage IV level of water shortage emergency. A proposal was submitted by interested parties which requested an exemption for "fault tolerant grasses" from the limitations defined in the Goleta Water District Code (Board of Directors, Goleta Water District, 2014, July, p. 5-3).

An analysis of past meeting agendas shows that such requests to alter any of the policy documents are not a regular consideration. Still this exhibits the democratic nature of the Goleta Water District operation. The proposal was discussed between the board members then tabled for further discussion by the Water Management & Long-Range Planning Committee sources (personal observation from Goleta Water District monthly meeting, February 14, 2017).

A future of water policy and water use.

Policies that impact the operation of the Goleta Water District descend from various levels of authority. As these are applied, they lay heavily on top of the Goleta Water District management. Policy dictates from those who exercise overarching authority tend to exert pressure by way of subsidies from taxes collected across the board imposed upon all local individuals and corporations. That is, federal taxes are partially returned to the local authorities only insofar as that local authority abides by applicable federal mandates.

This section includes a sample of the major policy document and a high-level analysis of the extant policy documents which directly or indirectly apply to the operation of the Goleta Water District. This listing is in no way exhaustive, but only includes those which sufficiently show the major impacts the subject small-scale family farmers, of policy with respect to drought responses.

Local resultant set of policies and real-world practice.

The term “Local Resultant Set of Policies” (RSOP) is borrowed from the security paradigm which is used by Microsoft in controlling a Windows information technology (IT) enterprise (usually referred by the user community as “the network” or “the server”). In reality, the system consists of any number of servers, desktops, laptops, switches/routers,

firewalls, and so forth. These are each referred to in IT parlance as "objects" as well as user accounts and groups. The Group Policy Object (GPO) is a series of settings which are defined to control what a user can do or what digital objects can be accessed and/or manipulated. Different groups of policy settings are developed to apply to the various types of objects such that a server object has a more robust security profile than a desktop or a standard user account has fewer privileges than an administrative account.

High level GPOs are applied to all objects in the IT enterprise whereas low-level GPOs are tailored to apply to only specific types of objects. The same basic principle is at work for virtually any organizational system where there are various levels of authority. There are high level requirements that apply to all and low-level requirements that are tailored for each specific local context. The conglomeration of these policies is then applicable to the lowest level of the system; hence my use of the concept of the RSOP.

The Goleta Water District is the lowest level of authority applicable to its local water customers. Yet there are policies which descend from the Federal, California State and Santa Barbara County entities whose purview includes water issues. There are basic policies which include water quality for potable user (SWRCB, 2016), and specific policies such as installation and operation of desalination plants or processing and uses of recycled water (SWRCB, 2016).

The current list of policies considered (references) consisted of thirty-one documents ranging in size from two (2) to five hundred seventy-five (575) pages. Though agricultural water use is mentioned at each level of authority (SWRCB, 2016), there is no focus on behalf of these that would reduce the prospect of bankrupting conditions. Therefore, without additional special consideration the chance of significant hardship coming upon this small

and voiceless group is great. The fact that the Goleta Water District board was lenient in the implementation of the shortage stage requirements, applicable to the agricultural community, indicates that they are aware of the precarious state of this set of their customers and perhaps the value of its contribution that belies its apparent quiet significance (Stumbos, 1993).

Stumbos' brief article (1993) describes a reality that has not changed since it was written. The values stated have changed but the message is no less important; small-scale farmers are not just simply valuable to our food supply, they are a critical component whose efforts constitutes 87% of national crop production (MacDonald, Korb, & Hoppe, 2013, p. iv). Despite this level of importance to the population at large, the water made available to the agricultural community is reduced and is considered a lower priority than business customers (Goleta Water District, 2014, July, p. 4-3). In a drought situation this exacerbates the farmer's plight, as we have seen from their stories, which expresses the resultant set of policies in a human life context.

Summary

Since the purpose of this research, expressed in the dual research questions, was to allow the subject farmers to tell their stories, the core element is based upon their very words. Their answers were interpreted to show the distinct as well as common themes. These themes were discussed to articulate the lived meaning.

CHAPTER FOUR: RESEARCH RESULTS

Participants' Profiles

The process of recruiting participants originated with the Goleta Water District publicly available data stating only that there were one hundred sixty-six agricultural connections on the system. However, no additional data could be gotten from the district staff. Privacy issues precluded their releasing the names and contact information of these customers.

The county agriculture commission registers all entities which use any form of commercial pesticides. This list is available on request. A list was requested of those location, entities and individuals operating in the city of Goleta. The list received, as a Microsoft Excel document, was based upon a search of the database for current, active permit holders in what is designated district 43449. The designated area coincides with the area code 93117.

The list received included one hundred twenty-three permits. The list was filtered to include only those which appeared to be actual farming operations located in the municipality of Goleta. The seventy-three remaining were invited to engage in the research using the approved recruitment letter, Appendix B.1. Email and phone calls were used as a follow-up to the letter resulting in eight positive responses. Three of those declined later. In addition to the use of recruitment letters, canvassing was performed at local farmers markets. This resulted in six positive responses and the receipt of contact information. However, when these were contacted to setup an appointment they declined.

Further analysis of the seventy-three entities from the pesticide users list was conducted to determine which were actual farming operations. Phone calls to the entities and

internet searches identified fifty of them to be either not farming operations or not meeting the USDA standard for a "small-scale" farm. Many of these were either golf courses, nurseries, or apartment complexes. Thus, it is estimated that those actual farming operations connected to the Goleta Water District which qualify as small-scale farms is approximately twenty-three. This gives a sample size of approximately 20% of the target population. It can only be assumed that those who declined to participate did so due to time and schedule constraints or that the individual did not meet the requirement of being a small-scale farming operation.

The five participant farmers from the city of Goleta were interviewed for this study to learn their stories of dealing with the challenges, policies, and issues during conditions of water shortage. To protect the privacy of the participants each is identified by a pseudonym which are individual character or farming/ranching family from a movie or television show.

One of the participants declined to fill out Appendix D, Participant Demographics form. The demographic data that could be gleaned from publicly accessible sights has been included. All five participants were heterosexual males and married. Four considered themselves to be White or Caucasian and one was Hispanic. Three had children living at home with one of the children being a minor. Four ranged in age between thirty and sixty-four and one was over sixty-five. One had some college, two had bachelor's degrees and one had a graduate degree. For political views, one considered himself a conservative, two were moderate and two decline to answer the question. Four out of the five are fulltime farmers. However, one manages the operation of properties that he does not own, and another also owns and operates a nursery.

The mean length of the interviews was approximately 36 minutes with interviews ranging from 13 to 57 minutes, and the interviews resulting in a total of 50 transcribed single-spaced pages. I reviewed and analyzed the interview texts identify themes. The major themes were found to be: Policy, Climate Change and Negative Impacts

Table 1

Participant Demographic Information

Social Category	Count / average	Big John High Chaparral	Hoss Ponderosa	Farmer Jack A&P	Cheyenne Mountain Fortress	Rowdy Rawhide
1. What is your gender?						
a. Male	5	1	1	1	1	1
2. What is your age?						
b. 30-49 years old	2			1	1	
c. 50-64 years old	2		1			1
d. 65 years and over	1	1				
3. What is the highest level of education you have completed?						
c. some college	1					1
e. college graduate	2			1	1	
f. some postgraduate	1		1			
4. What is your religious preference?						
a. Roman Catholic	1		1			
i. Something else (please specify)	2			none		Christian
j. Prefer not to say	2	1			1	
5. Race: What is your race? Are you White, African American, or some other race?						

Social Category	Count / average	Big John High Chaparral	Hoss Ponderosa	Farmer Jack A&P	Cheyenne Mountain Fortress	Rowdy Rawhide
a. White	4	1		1	1	1
c. Other (please specify)	1		Hispanic			
6. Other than the effort required for the agricultural operation, are you now employed full-time, part-time, not employed, or retired?						
a. full time	2		1			1
c. not employed	3	1		1	1	
7. Including yourself, how many people live within your household?						
	2.8	2	2	1	5	4
8. Are there any children under the age of eighteen years currently living in your household?						
a. Yes	1				1	
b. No	4	1	1	1		1
9. What is your marital status?						
a. single/never been married	1			1		
b. married	4	1	1		1	1
10. How would you describe your political views?						
b. conservative	1					1
c. moderate	3		1	1	1	
d. no comment	1	1				
11. Property Data						
When purchased/leased		1979	2012	2007	1996	2002
property size / total acreage	54.8	100	50	75	9	40
Years	19.8	40	7	12	23	17

Social Category	Count / average	Big John High Chaparral	Hoss Ponderosa	Farmer Jack A&P	Cheyenne Mountain Fortress	Rowdy Rawhide
Crops		Virtually all standard vegetables, specialty vegetables and a variety of herbs	Avocados	Tomatoes, Squash, Peas, Lettuces, Carrots and Celery	avocados, coffee, caviar limes, Cherimoyas, passionfruit, and pitaya	Avocados
Goleta Water District Connection(s)			Well water only		1 – 2”	

Farmer Narratives

Big John of the High Chaparral

Figure 2 - *Post Drought Rebuilding on the High Chaparral*

Big John of the High Chaparral had been farming locally for a few decades and weathered each of the intervening droughts. John and his wife are from the era of “hippies” who wished to live a more natural lifestyle. Together, with their son, they operate several locations in the city of Goleta, providing a variety of vegetables to local grocery stores and farmers markets as well as “clubs” that allow individuals to sign up for regular boxes of various vegetables and fruit.

Big John tells a decades long story of farming in the Goleta area. Having survived a few multi-year droughts since beginning this career (California Department of Water Resources, 2015, p 41), he speaks of a varying set of Goleta Water District policy as well as social circumstances that have impacted his family's ability to make a profit in this business.

> And they [Goleta Water District] told us how much water we could use. They did not raise the rates. And we stuck within the water they could, we could use which was like half as much as we'd been using previously. And, we got through it. And in probably '92, there was, you know, some saving grace that the reservoir got filled and it was over. It was the March Miracle thing (Big John, 2019)

Figure 3 - High Chaparral During Drought Conditions

The significant difference between previous droughts (1975 to 1977, 1989 to 1991 and 2007 to 2009) and the most recent (2012 to 2019) is that the number of residential water customers in the City of Goleta has grown significantly, causing a significant strain on the Goleta Water District resources. At the same time the Goleta Water District has increased the cost to the agricultural community as a "drought surcharge" making the use of Goleta Water District water for irrigation too costly.

> . . . we just don't plant the land that has expensive water on it except if we have to. And we do it only in the winter when it rains and when there's not as much water requirement. In the summer, something has to be watered every week. But in the winter, the way this winter's gone, we haven't had to water very much at all (Big John, 2019)

Figure 4 - Formerly Fallow Rejuvenated Property

During the most recent drought John had to shut down operations on locations that were primarily irrigated with Goleta Water District water. In addition, he and his family planted crops which did not require as much water. This required coordinated tradeoffs to ensure that there was a market for the new crop as well as enough profit to support the changes.

> But the water is not the only reason. Labor is hard to come by now with the border being closed . . . so, we're just planting less land. And, so, some land doesn't get planted because the water costs too much (Big John, 2019)

Because of the crop changes irrigation methods demanded additional labor efforts. This was negatively impacted due to immigration issues. Current technology has developed to the point where he has more effective water use. Drip systems controlled by moisture

sensors having replaced virtually all sprinkler and flood processes. This method has had the additional effect of requiring more labor going forward.

> We need water, but that's being challenged by the water companies allowing 1% more water to be given to new things every year. And so, after 20 years, 1% becomes 20% (Big John, 2019)

Big John is concerned about the impacts of climate change, since this is a family run operation. He expects to retire soon and hopes that his children will be able to continue to operate and make a living for their families with the properties that use well water. The impact of residential development on overall water demand has been significant though incremental. His concern is that future development will exacerbate the issue of occasional water scarcity.

> No, we haven't done that [contact the Goleta Water District]. No, we haven't petitioned anybody [government agencies]. We just pay high bills and we mostly don't pay them because we don't use the water (Big John, 2019)

Seeing the change in personnel at the Goleta Water District, both professional staff and elected board members, since the last significant drought (1989-1991) Big John felt that any effort to communicate with the authorities was futile.

> [regarding Goleta Water District drought stages] But they only got to this level . . . . And they're in three and they're four and five. And one of them says no more outdoor watering . . . . And the next one says no more lawn watering. Or whatever . . . and probably raises the rates again. But we're not anywhere near that right now. In my opinion. And everybody else that has to pay. I mean, why did they raise farmer's rates four times, but consumer's rate didn't even double? (Big John, 2019)

According to Big John the rates for agricultural customers increased by a greater factor than the residential customers. He feels this is not a fair method and that all customers should have been treated the same.

Cheyenne of the Mountain Fortress

Figure 5 **-** ***Post Drought Rebuilding in the Mountain Fortress***

Cheyenne, of the Mountain Fortress, runs two different farms each with its own Goleta Water District connection but also has access to use well water. Cheyenne has been operating these farms for over twenty years.

Cheyenne started farming in the early nineteen-nineties, growing organics crops. He now operates the farm with his wife, and their children as well as his parents. The family farm became a pioneer grower of new and different fruit, and a leader in the evolution of California as a region where crops, that grow well elsewhere in volcanic soil, are farmed.

Eventually the element which grew these new additional crops was spun off as a separate business unit. This business works with several partner farms in California, working to develop southern California as the first specialty crop growing region in the continental United States. As Cheyenne notes:

> I went from production of close to twenty acres down to eight. And now I'm trying to replant those acres again, with better Crops. I'm trying to rebalance. In perennial

> agriculture, so it takes a while. So, there's a lot of indefinite that needs to happen (Cheyenne, 2019)

During the recent drought, the total acreage under production was reduced to eight from twenty to minimize the amount of water required to be purchased from Goleta Water District. Coming out of the drought has the family replanting the fallow acreage. The chief concern is that, with additional planting, that there will be enough rainfall to aid in returning the acreage to full production. But their additional concern is whether the market for the newly planted perennials has enough demand when they are ready to harvest. Being as some of this product has a five to six-year growth cycle makes this effort a particularly vulnerable step.

> You're planting something that will give you return in year five or six, so you're always thinking "well, what's our market", but I felt like I have more control of that than I do my water, not necessarily water supply, but water prices (Cheyenne, 2019)

Despite the risk, Cheyenne and his family are also planting a new and diverse set of crops, which he would not specify. His desire is to surprise the market and hopes to dominate it while he is the only farm producing this new line of crops.

The common theme about the Goleta Water District is the price of water, and in particular, the basic connection price, surcharge and the agricultural rate. He feels that each of these is exorbitant and could lead to some farming operations going out of business.

In addition to the concern for the cost of water from the Goleta Water District, Cheyenne is apprehensive about the continuing expansion of the city of Goleta. With each new apartment, condo or house, there is additional demand on the water supply. And as the supply decreases during any condition of water scarcity, he knows that the Goleta Water

District will generally raise the rates on agricultural customers since they use the largest volume of water among the various types of connections.

A point that he makes is that, as he understands it, Lake Cachuma, the main water source of Goleta Water District, was originally built, by the US Bureau of Reclamation, to support the agriculture community of Santa Barbara County. He also said that the cost of the dam (a state bond issue) was paid off in October of 2016. Since then the actual cost of the lake water should have gone down; but it has not.

> I see the board acting more as a private for-profit company, acting as a housing policy affair and not as a community builder… this community needs a balance of agriculture that's always been this community's foundation. At the same time, it's still an important part of the economy and it's an important part for fire safety (Cheyenne, 2019)

Cheyenne sees this paradigm as the Goleta Water District board acting as a private for-profit entity rather than a community builder. He considers the balance of agriculture and housing as a foundation for the Goleta community as well as an important part of the economy. Cheyenne also states that, the various farming operations in the foothills of the Santa Ynez mountains acts as a buffer when there are wildfires in the Los Padres National forest.

Cheyenne was able to engage with the Goleta Water District in the past as part of the Cost Study Committee representing the agricultural community of Goleta. The committee was convened in 1996 because of the State of California passing Proposition 218, an amendment to the state constitution. Proposition 218, called the "Right to Vote on Taxes Act", included the local initiative power which could be used to reduce or repeal local taxes like utility user taxes or utility fees and charges for water including drought fees and surcharges.

The committee debated and discussed the various elements of water cost. It was determined that, at that time, the Goleta Water District did not have an accurate measure of the actual cost for water for each customer class. It was seen that there was a group of farmers who used water from what is known as the "west conduit", which is not filtered or chlorinated and therefore ought to cost less than the water used by residential, commercial and institutional users. But there was no administrative adjustment to this group of farmers.

During the committee meetings Cheyenne found it was difficult to get the Goleta Water District staff to provide cost data. Invariably he and the other non- Goleta Water District members would have to issue a formal public request to have any information to discuss among the committee members. He felt that often the Goleta Water District staff might be attempting to hide information which might reflect negatively on them. In his word the Goleta Water District staff were "sandbagging" him.

The experience of working with the Goleta Water District on the Cost Study Committee left him feeling that he could not trust either the Goleta Water District professional staff or the board of directors. He felt that the tendency to lack openness on the part of those members of the Cost Study Committee from the Goleta Water District was a cultural element of the staff and board members. Therefore, he assumed that it would not likely change without a significant personnel turnover of staff and the board of directors in office at that time.

In discussing trade-offs to sustain operations during the drought, he stated that the "first knee jerk response" was to cut back on resource use; water, that is. There were times during the worst part of the drought where the decision to plant a crop was an expensive gamble since there was the prospect of having no rain to supplement the expensive source of

the Goleta Water District. Efforts to implement a diversification strategy had to be set aside due to the increased cost of Goleta Water District water.

Cheyenne also took some business-based steps as a protective measure for his family. Whereas he had operated as a sole proprietorship, he formed a corporation to run his farm as well as managing other farms. Incorporating also was instrumental in allowing for better financing terms.

> the fact that the lake is at 80% plus this week (Santa Barbara County – Flood Control District 2016) and we've asked to drop our surcharge, I can refocus my efforts and I think of a two three year run in which we will go for building market; I'm developing new crops, I'm not going to say what that is . . . But I feel like we have a good run to try and rebuild the farm and provide ourselves and farmers with a new revenue model (Cheyenne, 2019)

As the area was coming out of the drought condition, he was daily checking the level of Lake Cachuma. When the lake reached 80% of its capacity the drought would be officially over. This would force the Goleta Water District to discontinue the drought surcharges and reduce the per acre-foot charges bringing financial relief for the agricultural community. When the lake was at 79.8% capacity, the Goleta Water District rescinded the Stage III and Stage II drought condition but left the Stage I in place. Thus, despite how close the level was to declaration of the end of the drought, the Goleta Water District was still collecting the drought surcharges and increased per acre-foot charges.

As Cheyenne and the farming community came out of the drought, their financial situation was bleak, since their production had severely suffered, and the water cost had taken so much of their liquid assets and in some cases required going further into debt. This condition has inhibited their rebuilding process.

> We have two types of drought happening and I think one of the underlying frustrations of the farmers was that we are hyper aware of the situation in Lake Cachuma. I can tell you that most of the farmers are watching daily levels. But the naiveness (sic) of the water district to say "hey we don't trust the farmers understand what's going on with the drought so we're better off just doing a surcharge so that we can economically force them to use less water". (Cheyenne, 2019)

Comparing the most recent drought to previous droughts Cheyenne has farmed through, he spoke of the drastic difference in the behavior of the Goleta Water District. The universal drought surcharge and increased per acre-foot charge of 300% was the chief of his complaints, along with the intransigence of the Goleta Water District staff and board of directors in responding to public requests for data.

He further discussed the difference between a drought which is the result of insufficient precipitation and a drought brought on by increased demand. Specifically, he questioned the continued residential development in the city of Goleta without the consideration of how to provide adequate water for this expansion.

> …because of the timing and in terms of the drought time and technology there is a host of new tools out there, not only censoring tools, but moving into controls. So that we in fields can be better users of water, I think these technologies have been kind of limited to greenhouse production. But I think we've seen an emergence last two or three years of a bunch of sensing technology and water use, and so, we're going to incorporate that but it's still not like a clear task. I think we still need another year or two before the-the cream of these technologies rises to the top (Cheyenne, 2019)

Despite these negative issues, Cheyenne said that the drought condition did have the positive impact of new technology being developed and deployed throughout the agriculture community which more effectively uses water, in particular, moisture sensors that signal a targeted drip system to turn on or turn off water to optimize irrigation. This is important because some crops will do well with a specific level of moisture while others will require

less. Computer controls configurations ensure that a crop does not get too much water nor too little; but only the exact amount that will generate the best production. All this technology is controlled by an application that he has on his mobile device. Another technology is designed to avoid wasting water from leakage, the flow rate for a given loop is calibrated and if that flow is too low it is assumed that there is blockage. However, if it is to high, that would be assumed to be a leak. Both conditions would require action to remedy the situation.

The drought has had its human impact as well. Because there was less product produced there was less to harvest. This impacted the migrant labor community. With lower production fewer consumable goods were employed on the farm thus impacting the vendors who sell these items. Because of the financial and social stresses Cheyenne and these others who rely on his operations for their sustenance suffered loss. At times family member were required to seek employment off the farms to supplement the family income.

The farm workers from the local community who might have worked on his farms would need to travel farther from home negatively impacting their families. Since there was less work to complete the workers would come home with less income than they were accustomed to.

In considering what the worst-case scenario might consist of Cheyenne felt that, in the fall of 2016, he, his family and those who are connected to their farming operation were almost at the point where they would have to sell the property and go find other work. The level of Lake Cachuma had sunk to about 7% of capacity and that little bit of water was not fit for any potable or irrigation purpose. That December the area received a volume of rain that was significantly above even the record high, but even that did not provide enough relief.

It was not until the following March when additional precipitation improved the situation such that Cheyenne was convinced, he would not need to sell the family farm.

> … when I say drought, it's a "policy price drought" on top of the actual physical lack of water (Cheyenne, 2019)

Applicable old sayings come to mind such as "adding insult to injury", "rubbing salt into the wound", etc., since the farmer is already stressed by the fact that the lack of precipitation causes the water table to drop leaving their thirsty crops dehydrated. The small-scale farmers' situation is then exacerbated when the Goleta Water District increases their rates as well as levying a surcharge.

Farmer Jack of A&P

Farmer Jack of A&P grew up in a farming family. This heritage extends back four generations. The family farming operation of his childhood involved little involvement on his part since the property under production was several thousand acres. He occasionally helped, as required by his parents, but his heart was not in it. He lacked interest in the farming lifestyle and did not enjoy the climate of the family farm's location.

> I came from the world of farming . . . very large acreage, traditionally very conventional farms . . . . my dad and uncle's farm [was] on a scale of thousands of acres of produce, most of it [was] lettuce. They rotated with wheat and a lot of sugar beets and then try other different stuff throughout the years, and then sweet onion is the other big one. But all very, very large acreage, so it's very mechanized, very scaled up and a more conventional approach (Farmer Jack, 2019)

He escaped to the central coast of California to attend college at the University of California Santa Barbara. During his college years he worked often as a gardener as well as kept a small vegetable garden for himself. After graduation, having learned to enjoy the climate of the Santa Barbara area, he decided to settle and take a job employing his business degree.

> When I was done with school, I was working an office job and decided I didn't want to do that … I ended up meeting a guy and getting involved with helping him write a business plan to . . . convert from growing cut flowers to start doing organic vegetables and do a CSA [Community Supported Agriculture] (Farmer Jack, 2019)

A childhood acquaintance, who had also relocated to the Santa Barbara area, invited him to join in a venture to operate a cut-flower farm on a two-acre parcel in Goleta (2007). After the first year they decided to change their crop to organic vegetables. As the business prospered, they acquired additional acreage eventually expanding out to fifty acres.

> …we kind of expanded onto a couple other smaller, a couple of acres and then a 10-acre property and getting into more farmers' markets. I partnered up with a guy that I'm now business partners with on it about after year one, and he's been with me since… it's kind of just been a slow growth… we're now at 50 acres total… we've slowly grown up to where we're at now and we still do the farmers' markets. We no longer do a CSA [Community Supported Agriculture]. We sell to local restaurants and the local grocery stores, and in the last few years especially, have developed a lot of . . . wholesale . . . larger volume business with different kind of distribution companies and larger grocery store chains (Farmer Jack, 2019)

To his family, Jacks entering the field of agriculture after completing a business degree at the University of California Santa Barbara seemed to be a poor choice. As he began to attain a level of success by showing a profit his parents began to think that he had found his life's pursuit.

> Originally, they thought I was crazy, but they actually have been huge supporters of mine . . . . They just want me to be successful (Farmer Jack, 2016)

The recent drought began to impact their operation in their fifth year (2012). As the availability of water to the Goleta Water District dwindled their rates increased significantly, such that, Jack and his partner were required to leave much of their land fallow, only continuing to work fifteen acres that was supplied by a well (2016).

> It's really expensive. Just a comparison, I think we pay right now in Goleta Water District, which we're right now not watering any crops on these rates, we kind of gave up as soon as they enacted them, but I want to say it's close to $2,000 per acre

> foot… don't quote me on that, somewhere around there. I know like where … where my dad and uncles are farming, they're paying more like, 20 bucks per acre foot (Farmer Jack, 2019)

Figure 6 - Property Left Fallow and tilled during the Drought

The exorbitant cost of water made it difficult to complete with farms in locations where water was not in short supply. Central American farmers were shipping produce to Jack's customers at times below the cost that he could afford to sell at. This was despite the additional transportation cost of the Central American farms. Even the farms in the northern part of the San Joaquin Valley (California), also suffering because of the drought, were competitive.

> . . . technically, in the larger world of produce, you know, you're competing against people all over- all over California and even, you know, Mexico and throughout, but to have those- that big cost is- is a big hindrance to really- to really be competitive in what you're doing and, you know, beyond it being unaffordable, the- the scary situation is we're really just pretty short on water. (Farmer Jack, 2019)

The Goleta Water District has since reduced the water shortage stage from Stage III to Stage I, on May 1, 2019 and then terminated Stage I on August 13, 2019. With these changes the cost of water to the agricultural customers has been decreased to the standard

rate and drought surcharges rescinded. Still, the local Goleta farmer is struggling. The financial impact of the drought has left Farmer Jack short of liquid assets to spend on rebuilding his farming operations.

Figure 7 - Rejuvenated Property Fallow During the Drought

> . . . we're still figuring this out, what we're good at . . . . get our niche and what it is we wanna grow and what- what we're trying to do. I feel like the demand is very real for really good fresh produce and, you know, organic and- and consciously kind of raised stuff...

Farmer Jack is fortunate that he had built a significant customer base locally as well as regionally. The business of supplying goods for Community Supported Agriculture (CSA), farmers markets, grocery stores and restaurants has allowed his operation to remain financially stable. Still the impact of Goleta Water District drought policy will take some time to overcome.

Rowdy of Rawhide

Rowdy of Rawhide operates a fruit and avocado farm of approximately 18 hectares as well as a nursery. His family, a wife and two adult children, are the main employees for both operations. They employ an addition farm-hand fulltime and seasonal laborer for harvesting.

> What are my most pressing challenges? Make my mortgage payments. Well, you know that's a reality. . . that is . . . I mean, we live month-to-month because, your question is short-term, just being financially able to make those payments with the cost of water, and the cost of the government involvement. (Rowdy, 2019)

Rowdy's need to profit from the products of his family land is impaired by the interference by various government agencies, in addition to the Goleta Water District, mainly, the Santa Barbara County zoning authorities. As a result of the recent drought, production decrease required not only shifting funds from the family's nursery business but also setting up livestock boarding to continue operations.

> . . . we have . . . 35 horses on the ranch that board and these people . . . come in and they build their structures on a 25 by 25 piece of land and they lease that from me . . . . some neighbor called the county and complained that our structures were unpermitted or illegal, which didn't need a permit, but it gave the county the opportunity to enter my property and start looking for red-legged frogs and everything else . . . . $20,000 plus later, we finally have gotten approval. (Rowdy, 2019)

Apparently, a neighbor (who he says is well off and politically connected) complained about the horses being on the property. This led to a long court case which cost the family over $20,000 in attorney fees and court costs; despite the property being zoned for livestock.

This issue, in addition to the drought impacts, nearly required the family to literally sell the farm. Significant rain during the winter of 2016 and 2017, improved the family's situation to the point that they were able to survive financially.

At one point, prior to the respite of precipitation, he had entertained the prospect of changing the zoning and developing the property as a condominium complex. This plan was quashed by the county planning commission.

> . . . the Santa Barbara County agriculture department has been very, very supportive, educational, helpful . . . . I don't want to dis them . . . keeping us safe . . . using safe

> practices . . . of agriculture, of insecticides . . . . I respect them . . . . They're educators, They're not enforcers (Rowdy, 2019)

One positive relationship that Rowdy has with the county is with the agriculture department. He says they have been very helpful, providing education for issues that he and his family have had to deal with as farmers. As a registered user of insecticide, he has a federal inspector come annually; this is generally an opportunity for teaching rather than finding fault and applying fines.

> Not a problem, as far as that agency (Santa Barbara County Agriculture Commission). The Goleta Water, on the other hand . . . a bunch of nimrods . . . . I reduced my Goleta water . . . by 50% when they asked . . . . And my water bill went from $700 to $1700 . . . (Rowdy, 2019)

Rowdy is convinced that the sudden decrease in demand, as required by the successive drought stages instituted by the Goleta Water District Board of Directors, resulted in a subsequent reduction in revenue for the Goleta Water District. He believes that the increase in acre-foot cost for farmers was intended to make up for that loss. Whether this was the actual mindset of the Goleta Water District management or not, any increase in the rate charged to the agriculture community would certainly generate the greatest increase in revenue, since the farmers represent approximately 90% of the total demand by volume.

> I spent a half a day searching and found it six feet down, because it has . . . going into the creek . . . . It wasn't a wet spot . . . . I said, "Hey, give me a break," you know, "I didn't misuse this water . . . . And they said, "Well, you've used our one-time broken-pipe policy. There's nothing we can do (Rowdy, 2019)

Rowdy has also been frustrated by the Goleta Water District policies which deal with events beyond his control. A broken pipe resulted in an additional nine-hundred dollars in a single bill. This was because the Goleta Water District only allows leniency for a single

broken pipe episode. Any further issues experienced by a farmer which cause a loss of water or excessive use are billed as well as any penalties such as a drought surcharge increase.

> . . . we pump the water out of the creek and that's the only way we've been able to survive. But a lot of the ranch is on Goleta Water . . . . if my whole ranch was on Goleta Water, I wouldn't be talking to you, I'd be out of business (Rowdy, 2019)

Rowdy's property has a small water course running through it. This allowed him to have an additional source for irrigation other than the Goleta Water District. Though it only occasionally had water flowing it did provide a respite that helped his family to survive the drought.

The irrigation infrastructure on Rawhide is antiquated. Rowdy wants to upgrade this condition, but the financial difficulties caused by the drought have made that all but impossible. He has sought out funding through state grants but was convinced that he would not be eligible as a result of his ethnicity. This is despite his admission that his lineage stems from Spain by way of Mexico eight generations in the past. He said ". . . I don't want to play a "race card", that's not me" (Rowdy, 2019)

> . . . and it's got to be our family running it . . . and we can't afford any labor. So, my 28-year-old lives upstairs and my 31-year-old daughter lives upstairs and she runs the . . . nursery. So, it's all a family . . . (Rowdy, 2019)

Rawhide employs only one fulltime employee that is not a member of the immediate family of Rowdy. He has worked at Rawhide for over ten years having earned the trust of the family to the extent that he has benefits including vacation accrual. Unfortunately, due to the downturn in production resulting from the drought, his vacation was cut from two weeks to one week. For the family, however, there is no holiday or vacation. Sadly, their lone laborer hasn't had a pay raise since the beginning of the drought.

> . . . sales of our business at [the]Nursery . . . we're at all-time low gross sales . . . even though we've had this rain, it still won't catch up 'til next year when we will start to see . . . . lead-out businesses or residents saying the drought it's over with . . . . We're going to start watering our yards again (Rowdy, 2019)

The drought not only impacted the farming operation but the family's nursery. The Goleta Water District taking steps to implement the various stages of water shortage required the residential customers to cut back on usage. This appears to impact the amount of effort and assets that are expended to maintain residential properties. Thus, purchases at a nursery would naturally decrease. Since the farming operations of Rawhide was already in financial distress the downturn for their nursery business only exacerbated their situation.

> . . . we are way, way down from last year, which was probably our worst year. So, we're just hanging on there . . . . the water [issue] doesn't help. You know, it's just a nail in the coffin . . . I mean . . . I think another year would have killed us. I mean ... the fact is, it's not over . . . because we're still feeling the ripple . . . (Rowdy, 2109)

As they emerge from the drought, the financial strain is evident in Rowdy's words as well as his quivering voice; he is almost in tears. He speaks of being an eighth-generation resident of Santa Barbara County and how he hoped to leave the farm and the nursery as a legacy for his children, and their children. A member of a band that plays at local night spots, gives him the occasional escape from the stress of his circumstances.

Having undergone a recent unspecified surgery, Rowdy is currently unable to do the manual labor that he would normally perform. It is evident that this causes him much heart ache while he is also dealing with the pain from the surgery. This pain also impedes his ability to perform with his band bringing further emotional discomfort.

Discussing how the family might make ends meet Rowdy speaks of reducing all non-essential expenditures to the point that there are no funds available for recreation. Family

vacations will be few if there are any. He also considered increasing the rents he charges for the boarding of horses. And even speaks of selling the property he and his family have worked since shortly after the beginning of the millennium. He had attempted to sell a part of the property, but the Santa Barbara County Planning Commission and zoning authorities would not allow it since the area is zoned for forty-acre parcels. He even offered the property to the complaining neighbors (apparently very wealthy) but they declined.

Hoss of the Ponderosa

Hoss of the Ponderosa, though a longtime resident of the area, had no family nor had ever been involved directly in agriculture. He had worked in a high technology industry working his way up to management, doing quite well for himself and his family.

> I've done quite well here at [employer] and always have received great raises. And then there's the promotions up through the engineering community. And now I do program management which pays even better. So, I had to do something to protect my income from taxes (Hoss, 2019)

Hoss purchased an avocado orchard as a tax shelter for his income. The property he bought did not come with any connection to the Goleta Water District system but only utilized precipitation and an existing well. It was his understanding that he could not have both Goleta Water District as well as well water used as irrigation.

> I know some other farmers, so I am aware of the problems they have been having. With my well to get irrigation I don't need to use the Goleta Water District's water. So, the higher price didn't affect me (Hoss, 2019)

Hoss continues to work in a management role at a technology company while only tending his orchard part time, employing additional labor intermittently as necessary. Having a friendly relationship with other members of the agricultural community, he is aware of the

issues experienced by those who predominantly use Goleta Water District water for irrigation.

> I still had some issues because the ground has gotten very dry. So, I have had to run my pump longer to get the ground saturated (Hoss, 2019)

Despite only using well water, the recent drought has impacted his operation. As the water table subsided, though increasing the irrigation volume from his well, yet production suffered, requiring pruning some of his trees to the stump. This is a common practice in avocado farming for periods of water scarcity; pruning to the stump saves a full-grown tree from loss. Assuming a drought has ended, the tree can be back to full production in three to four years.

As with other farmers Hoss has implemented modern technology to manage the irrigation process more effectively. Drip systems and moisture monitoring minimizes water use to a level that is optimum.

> We still had come good results even in the worst part of the drought. I only had problems with enough workers to do a complete harvest (Hoss, 2019)

Labor has also been a factor in his production with the reduced availability. Hoss believes that this is because of immigration issues. The attempt to "close" the border by the current administration has had the apparent unintended consequent of impacting food safety.

There is a stark contrast between the experience of Hoss and those farmers who used Goleta Water District irrigation water exclusively. Hoss' had a more positive outlook compared to the other farmers in this study; he seemed to be content with the situation and not at all under any stress.

The Participants

The individuals in this study were in many ways homogeneous but at the same time varied. All of them were educated; having from “some college” to post graduate work. The participants exhibited remarkable resilience in their stories of working through the difficulties inherent to farming during a drought. They each dealt with the Goleta Water District in different manners, from no effort all to contact, to joining in a committee established to study water cost in Goleta.

Farmer Stories

The objective of this study was to tell the stories of small-scale family farmers, who purchase their irrigation water from the Goleta Water District, tell of the challenges, policies, and issues during conditions of water shortage and to have them describe the impact of applicable policies, as implemented by the Goleta Water District Board, which deal with Goleta's water shortage challenges. I hope that these stories will speak to the community at large and the powers that be which might lead to changes that could aid the farming community during conditions of water shortage.

As the interviews proceeded and themes began to emerge, there were a few categories that took shape and began to define the concept (construct) of their stories. These included: (a) Policy; (b) Climate Change; and (c) Negative Impacts.

991 **Table 2**

992 ***Relevant Themes Derived from The Farmer's Words***

	Major & Minor Themes	Number of participants
Major Theme	**Policy** Various policy types inhibit the ability of a farmer to produce crops	4
Minor Theme	Water policy during conditions of water scarcity exacerbates the issue of insufficient precipitation	4
Minor Theme	Zoning policy prohibits the farmer from using property for purposes other than agriculture to supplement agricultural income	2
Minor Theme	Local policy allowing continued development (residential, commercial, etc.) increases demand on limited water resources	3
Major Theme	**Climate Change** Climate Change is expected to continue with nature caused droughts occurring with greater regularity and longer duration.	3
Minor Theme	Reduced precipitation locally impacts the availability of the main water source as Lake Cachuma level decreases	5
Minor Theme	Reduction in available water from Lake Cachuma causes the Goleta Water District to increase use of well water from the Goleta Valley aquifer lowering the water table already reduced by the drought	5
Minor Theme	Reduced precipitation in northern California impacts the availability of the supplementary water source in the state water plan	5
Major Theme	**Negative Impacts** Negative Impacts result at intersecting elements of the farmers lifeworld	5
Minor Theme	Human: All those who are associated with the farmer, whether personally or professionally, experience some level of difficulty	5
Minor Theme	The Family is directly impacted; this impact is of the greatest negative value including the emotional element of frustration and fear	5
Minor Theme	Hired Labor are impacted as the crops fail to produce a enough quantity to employ their services	1
Minor Theme	Vendors of farming appurtenances and agricultural services are impacted as fields are left fallow or orchards are cut down	3

	Major & Minor Themes	Number of participants
Minor Theme	The financial issues experienced by the farmer "trickle-down" to associated individuals and entities	4
Minor Theme	The farmer balances the cost of water against the outcome of crops to ensure enough profit (or as little loss) as possible to be able to continue in the succeeding growing seasons.	4
Minor Theme	With less crops there is less effort required to operate the farm so Laborers will have less income or none.	4
Minor Theme	With less farming operation, less consumables are required, and capital investments are reduced thus impacting the Vendor of these goods and services.	4

Policy

> [regarding Goleta Water District drought stages] But they only got to this level . . . . And they're in three and they're four and five. And one of them says no more outdoor watering . . . . And the next one says no more lawn watering. Or whatever . . . and probably raises the rates again. But we're not anywhere near that right now. In my opinion. And everybody else that has to pay. I mean, why did they raise farmer's rates four times, but consumer's rate didn't even double? (Big John, 2019)

Having been farming in the Goleta area for over forty years, Big John had experienced droughts before the most recent one. The previous droughts did not incur rate increases or a so-called drought surcharge enacted by the Goleta Water District Board. Cheyenne was concerned about the impact of Goleta municipal housing policy. Residential expansion would bring additional commercial enterprises, both industrial and retail, which would demand a share of the fast-depleted water source. He described the impact of Goleta Water District Board policy as a “policy drought on top of the physical lack of water”. Farmer Jack spoke of the financial struggles endured during the drought that resulted from the Goleta Water District Board policies. Still, he kept a positive attitude about the future as he began to recover. Rowdy felt that the overall Goleta Water District Board drought policy worked to almost lead his family to losing everything.

> I said, "Hey, give me a break," you know, "I didn't misuse this water . . . . And they said, "Well, you've used our one-time broken-pipe policy. There's nothing we can do (Rowdy, 2019)

Policy implemented from any level would be assumed to provide or instigate some positive result for the circumstance to which it applies. Among these farmers there appeared to be an expectation of the Goleta Water District Board drought policy showing them favor or at least minimizing any penalties. They certainly did not anticipate having their rates raised to such a level that they might not be able to continue to operate.

Climate Change

Big John saw a future of recurring droughts as guaranteed with climate change continuing apace. He is hopeful that his children will be able to continue to work the family farm with minimal impact. Cheyenne sees climate change as a major factor in the future of agriculture. Without adequate precipitation locally he expects that production will suffer with little relief. Rowdy anticipates another multiyear drought sooner than later as a result of climate change. With the added burden of the Goleta Water District drought policies Rowdy will continue to struggle, even in the wet years, hoping they last until the next drought.

> . . . sales of our business at [the]Nursery . . . . we're at all-time low gross sales . . . even though we've had this rain, it still won't catch up 'til next year when we will start to see . . . lead-out businesses or residents saying the drought it's over with . . . . We're going to start watering our yards again (Rowdy, 2019)

Negative Impacts

Big John, Cheyenne, Jack and Rowdy each see the same effect on their life. Financial shortfalls lead to family spending for only what is necessary. What were once common expenditures for a normal family standard of living became rare. Travel was kept to

the minimum required for support of the farming operation. Hired labor was let go while seasonal labor hiring was reduced due to having less crops to harvest.

> . . . and my, my longest time employee, I think, is probably . . . something like maybe 12 years now with us... you know, his vacation got cut from two weeks to one week (Rowdy, 2019)

Goleta Water District Narrative

Since the Goleta Water District Board Members and senior staff were either unable or unwilling to engage in this research, I will use the Goleta Water District publicly available documentation to answer the questions in Appendix D.2, the Interview Protocol for Goleta Water District Board Members. Where a question is asking for an opinion the answer "NOT APPLICABLE" will be indicated.

Throughout the effort to elicit information from the Goleta Water District I experienced intransigence. Thus, it came as little surprise that the Goleta Water District Board and staff declined to participate. Bardach warned that, though policy research may be typically from a neutral and disinterested perspective, yet informants might be highly sensitive about the implications of what they might say (Bardach, 2012). He also cautions that there could be opposition to the findings of such research (Bardach, 2012).

Section 1: Background on interviewee and organization

To begin, I'd like to ask a few questions about your role at [organization] and some of the basic management challenges your organization faces.

1. I read on your website that you [do the following] here at [organization].
    a. Is this still your major responsibility?

NOT APPLICABLE

b. Is there anything else you are responsible for managing and making decisions about?

NOT APPLICABLE

2. What are the most pressing management challenges Goleta Water District faces?

a. What are the year-to-year short-term planning challenges faced by Goleta Water District?

> …water quality has become one of the most pressing challenges. As lake levels drop, water quality conditions degrade, thereby requiring additional treatment. Specifically, the vegetation that grows during dry periods decays when flooded, increasing organic matter in the water and deteriorating water quality. Wildfires in the watershed further compound the problem, resulting in debris being washed into the lake and increasing the nutrients available to algae. To maintain the high level of water quality ultimately delivered to customers, significant investment in enhanced treatment and various system upgrades necessary to blend surface water with groundwater will likely be required. Similar to adjustments in water supply, these new treatment and distribution improvements will only add to the overall cost of maintaining the water system (Goleta Water District, 2019 Summer)

b. What are the five-to-ten-year long-term planning challenges faced by Goleta Water District?

> …the District's diverse water supply provides a critical tool for navigating through droughts, the investment to protect this resource and the infrastructure required to access it come at considerable expense. This is especially true of the District's drought buffer, the Goleta Water Basin, where the ongoing maintenance and operating expenses associated with maintaining wells and related production and distribution infrastructure can be significant. Thus, long-term water is likely to be more expensive than was historically the case when the District could rely on Lake Cachuma to serve as its primary source of supply (Goleta Water District, 2019 Summer)

c. Among these management challenges, which are considered top priorities for Goleta Water District to address?

> …it only takes a few dry years to enter a drought and potentially several more for the resulting water shortage to dissipate. Keep in mind that the lake last spilled in 2011 and by 2014 the area was in drought. By 2016, Lake Cachuma levels were at 7%, which was the lowest since the Bradbury Dam's construction in 1953. While we've

> seen surface water supplies rebound quickly with a series of wet winter storms, it will likely take several years for the groundwater basin to fully replenish. As such, the District is now examining various capital improvements to its well field that are necessary to expedite the timeframe for basin recharge via the injection of available surface water (Goleta Water District, 2019 Summer)

d. How does Goleta's population growth and the expected rise in municipal water demand impact Goleta Water District's planning and decision-making?

> [According to the SAFE Ordinance]…no new or additional connections will be approved, except for projects have already paid their new water supply charge, or projects that have historical water credits for which the new proposed project will use the same or less water (Goleta Water District, 2014 October)

e. How does providing agricultural water fit into Goleta Water District's priorities and management challenges?

> Commercial Agricultural Purposes – as used in Goleta Water District Code Section 1.04.020 (A) means the growing of crops or raising of animals for the production of either food or fiber which is either sold or donated to a tax exempt organization for mass distribution. (Goleta Water District, 2019 April)

> The Cachuma Resource Conservation District provides free irrigation evaluations for growers to evaluate irrigation systems and make recommendations to improve performance (Goleta Water District, 2019 February)

3. How does Goleta Water District work with other local, state, and federal agencies to address the challenges we just talked about facing Goleta Water District? If not, what prevents Goleta Water District from working collaboratively with other agencies?

> Each director is a member of a variety of local and state agency committees and/or boards (Goleta Water District, 2019 January)

Section 2: Drought preparedness

How has Goleta Water District managed drought in the past and what lessons for the future have been learned from those experiences.

> Following the 1987-92 drought, the California Department of Water Resources (DWR) examined agencies' responses to the dry conditions across the state and their

> impacts. The majority of the State's urban water retailers implemented demand reduction techniques—either voluntary or mandatory—at some point during the drought. Demand reductions and allocation programs were typically accomplished through extensive customer education and outreach programs where mandatory rationing levels reached as high as 50 % in some communities. Small communities in isolated areas without back-up water sources and the ability to connect to other water systems typically had no recourse other than demand reduction or hauling water. Customers of agricultural water agencies reduced planted acreage to match demand to projected water supplies. Virtually all the State's larger water agencies implemented short-term demand management actions in response to the ongoing drought conditions. By 1991 most agencies were implementing significant demand reduction measures such as rationing, mandatory restrictions, surcharges and fines (Goleta Water District, 2014 July)

1. What has Goleta Water District learned about dealing with drought from previous experiences?

a. What are the tradeoffs you must make during droughts?

> Investments shifted from initiatives like hydroelectric turbines and solar energy projects, to activities that focused on strengthening the reliability of District water supplies and the infrastructure necessary to pump and deliver groundwater to customers (Goleta Water District, 2018 Spring)

b. How do you prioritize those tradeoffs?

> Lake Cachuma dropped to as low as 7% of capacity, imported water availability hit record lows, and groundwater replaced water from Lake Cachuma as the primary source of supply for District customers (Goleta Water District, 2018 Spring)

c. What has Goleta Water District done to deal with previous droughts that has prepared you for future droughts?

> Actively managing for the drought has been a multi-year effort with a number of initiatives… This planning has allowed the District to delay the more significant drought impacts, minimize the economic harm to the community associated with more severe restrictions such as banning outdoor irrigation or agricultural irrigation, and ensure adequate supplies of water remain available for drinking, public health and safety (Goleta Water District, 2015 December)

d. What do you wish Goleta Water District could be doing to better deal with drought?

NOT APPLICABLE

e. What prevents Goleta Water District from doing this?

NOT APPLICABLE

f. How does water for agricultural uses fit into your drought management strategies?

g. What concern do you have about Goleta Water District's capacity to deal with future droughts and water scarcity?

NOT APPLICABLE

h. What is the threshold that needs to be crossed for a drought to become an unmanageable emergency?

3.4 Process for Declaring a Water Shortage
Water Code Sections 350 to 352 dictate specific processes to guide the District Board of Directors in declaring a water shortage, including a specially noticed public hearing:
Cal. Water Code Section 350. The governing body of a distributor of a public water supply, whether publicly or privately owned and including a mutual water company, may declare a water shortage emergency condition to prevail within the area served by such distributor whenever it finds and determines that the ordinary demands and requirements of water consumers cannot be satisfied without depleting the water supply of the distributor to the extent that there would be insufficient water for human consumption, sanitation, and fire protection.
Cal. Water Code Section 351. Excepting in event of a breakage or failure of a dam, pump, pipe line or conduit causing an immediate emergency, the declaration shall be made only after a public hearing at which consumers of such water supply shall have an opportunity to be heard to protest against the declaration and to present their respective needs to said governing board (Goleta Water District, 2014 July)

i. In your opinion, how many consecutive years of drought can Goleta Water District handle given your current capacity and resources?

At this writing the water level of Lake Cachuma, the main source of water for the Goleta Water District, is at 143,775 acre-feet, 74.4% (Santa Barbara County - Flood Control District, real time). Prior to the beginning of the recent drought, during 2011,

the level reached the spill level; 193,305 acre-feet, 100% (Santa Barbara County - Flood Control District, 2016 October). In November of 2016 the level had decreased to only 7%. This water was deemed unusable due to the concentration of runoff chemicals and silt. At that time no local Santa Barbara Water Districts were receiving water from Lake Cachuma and were relying on wells to meet water demands. The Goleta Water District at that time had invoked Stage III Water Shortage. Stage IV was not declared nor Stage V, the most severe water shortage condition.

j. How do droughts affect Goleta Water District's interaction with other local, state, and federal agencies?

Each director is a member of a variety of local and state agency committees and/or boards (Goleta Water District, 2019 January). Any further interaction would be called for depending upon the water shortage conditions.

k. What enables you to work effectively across agencies in times of drought?

NOT APPLICABLE

l. What prevents you from being able to work effectively across agencies in times of drought?

NOT APPLICABLE

Section 3: Planning for change

Going forward, climate and other hydrological, ecological, and social changes may have an impact on Goleta Water District's ability to manage water. Now, I'd like to talk a little more about how Goleta Water District is planning with respect to the different changes that are occurring in the Goleta area.

1. What is the nature of the discussion within Goleta Water District about climate change?

Trends and drivers

Climate change may bring more severe, frequent droughts and wildfires, and give rise to more water quantity and quality issues (Goleta Water District, 2019, Winter)

2. What is Goleta Water District doing to manage and plan for climate change?

While climate change is a global problem, innovative organizations like the Goleta Water District are addressing it through local solutions (Goleta Water District, 2010)

a. If nothing, what prevents Goleta Water District from doing anything?

NOT APPLICABLE

b. What do you wish Goleta Water District were doing to address the potential impacts of climate change, which for this region have been predicted to be increased frequency, severity and duration of drought, reduced water availability, and changes in precipitation patterns?

NOT APPLICABLE

3. What are the biggest barriers for Goleta Water District to adapt to climate change?

No data

4. What needs to happen for Goleta Water District to more effectively manage and plan for climate change?

No data

a. What information would help Goleta Water District make decisions?

No data

b. What types of collaboration with the research community or other local, state, and federal agencies would help Goleta Water District?

No data

c. What policy changes or actions by the state legislature would you like to see?

No data

d. What institutional changes would you like to see?

No data

e. What infrastructural changes would you like to see?

No data

f. Is the current built infrastructure managed by Goleta Water District set up to deal with shifts in precipitation from snow to rain and earlier spring runoff?

5. In your opinion, how does climate change create new management and planning challenges for Goleta Water District?

NOT APPLICABLE

a. Given that we live in an arid state with frequent droughts, is climate change a novel problem for Goleta Water District?

No specific data

b. How does climate change make existing problems such as [list problems they mentioned previously one by one] worse?

No specific data

c. How would climate change create challenges for delivering agricultural water to farmers?

No specific data

d. How would climate change interact with the rapidly increasing population in Goleta?

No specific data

e. How would climate change interact with urbanization of former agricultural land?

No specific data

f. How would climate change interact with the current trend of transferring water from agricultural uses to municipal and other high value uses?

Current use of information and models

Regarding the information and models Goleta Water District is using to make water management decisions.

As the District celebrates 75 years, it is important to not only reflect on the accomplishments of the past, but to anticipate and plan for a future that is sustainable, financially sensible, and forward looking. Externalities like severe and cyclic droughts, increasing Federal and State regulations, and the need to replace aging infrastructure are all likely to present challenges in the coming years, though the exact timing and parameters of each of these potential disrupters cannot be known with certainty.
By attempting to understand the sources, timing and significance of these changes the District can plan for and predict likely outcomes. Being proactive provides an opportunity to influence these changes ahead of time to achieve preferred results (Goleta Water District, 2019, Winter)

1. What information is Goleta Water District using to predict water supply, both year-to-year and at the decadal scale?

No specific data

2. How is Goleta Water District coupling water supply and demand models?

No specific data

3. How is Goleta Water District modeling dynamic changes in hydrologic, ecological, and social systems when predicting water supply and demand?

STRATEGY
The experience of the past eight years of drought has emphasized the need to plan for system operations that permanently rely on the careful and strategic use of surface d ground water to meet demand. The District has updated its Urban Water Management Plan, Water Supply Management Plan and Groundwater Management Plan to reflect modeling from the current drought and completed a Recycled Water Feasibility Study and a Stormwater Capture Masterplan to examine potential options

> for increasing water supply and recharging the basin. At the same time, the Infrastructure Improvement Plan outlines targeted investments in the distribution system critical to ensuring that water can be moved quickly in large volumes throughout the District. These plans will guide prudent management of the District's water supply sources and infrastructure projects to invest in the right projects at the right time (Goleta Water District, 2019, Winter)

a. How is Goleta Water District taking into consideration these dynamic changes in future water management and planning?

> This dedication to developing and protecting a diverse water supply portfolio over the years has paid countless dividends to current residents. As infrastructure ages, additional investment will be necessary to make sure these valuable resources remain available into the future (Goleta Water District, 2019, Winter)

b. If Goleta Water District is not doing it currently, what is preventing Goleta Water District from considering these dynamic changes?

NOT APPLICABLE

Summary

The policy model of the Goleta Water District was well thought out by the primary author (Bachman, 2011). In reviewing the policies of similar municipalities, the plans, contingencies, and processes were comparable (not documented herein). The apparent intent of keeping the majority of customers supplied with the level of water demand are well defined.

Based upon the responses from the subject farmers these policies may necessitate a review with a focus that considers potentially larger issues. Though the prospect of policies driving any, much less all, small-scale farmers out of business may be minimal the reality that those of our subject provide a variety of benefits to the community might be taken into consideration. That the professional staff and board of directors declined to engage in this research is a dismal context.

CHAPTER FIVE: TENTATIVE CONCLUSION

Analysis

Tentative, because stationarity is barely a myth, much less a reality. The planet will continue to change, along with the solar system, galaxy, universe, and whatever reality might consist of that humanity has yet to recognize. Too, humanity will continue to change, evolving cultures and perhaps physiology. Each of these and many more are systems which impact the processes employed by the subject individual and all other farmers.

Five men described their lived experience operating a farm during the California drought, which lasted from 2012 to 2019, in response to open-ended questions that I posed. The inferences drawn are as cautious as the weather and climate that mainly determine their successes or failures. Decades of drought free years would leave this research and writing forgotten. The experience of the planet teaches that eventually there will be periods of water scarcity. Thus, our farmers, and then their children or successors, will ever be at the mercy of the unknown future; much as the rest of us.

Contrary to the lyrics written by John Martin Sommers and made famous by John Denver in the song "Thank God I'm a Country Boy", life on a farm is not exactly laid back. In fact, it is anything but leisurely, and mainly filled with significant chores. This is evidenced in a study conducted in Vancouver British Columbia focused on urban farming. Stolhandske and Evans (2017 March) found that of the six subjects in their study three were still in operation after only five years. The findings of this study are similar in that the stories are of enduring stressful physical and environmental hardships made more difficult by a condition of water scarcity; the California drought of 2012 to 2019. The difference being that none of the five participant farmers for the present study quit.

Results of the study indicated that each farmer comes to terms with their discreet circumstance, working toward overcoming the issues peculiar to their chosen vocation. Their stories lead us to believe that they are not pleased with the policies of the Goleta Water District. In their estimation the Goleta Water District Board consider the agricultural customers as insignificant in the general population of the Goleta area. Their treatment at the hands of the Goleta Water District Board could be considered a form of minority oppression.

As to their emotional state, non-verbal communication appeared to express from severe distress, through moderate anxiety to confident expectation of better times to come. Those with greater experience in the field seemed more at ease than those with less. Ringgenberg, et al, found that suicide rates for those involved in agriculture was five times that of all other occupations (Ringgenberg, et al, 2018). An in-depth study by a mental health professional of each family member might reveal deeper issues.

It seems that the Goleta Water District Board generally defined policy to cater to the majority at the expense of the minority. It begs the question, did the Goleta Water District Board consider that their policies might have a significantly negative effect in an unintended consequence upon the whole of the Goleta population? Yet this is a possible indirect impact in a worst-case scenario. Certainly, the failure of a few small-scale farmers would not foreshadow an impending famine. Yet this favoring of the majority could work toward an end that would negatively impact them in that decreasing the agricultural output increases commodity prices.; and in the worst case, a famine.

The farmer's answers to the interview protocol beg that other questions be answered. The accusation that the Goleta Water District is being run more as a business than a community resource needs to be considered. Just as any other elected official and appointed

professional staff at any other jurisdiction can be called upon to answer for their actions, the Goleta Water District board member should be also.

As seen from the research recorded in Appendix E, Historical Context, the dietary needs for humanity have changes little in the last ten to thirteen thousand years. The climates changes, as the planet moved from a glacial epoch into the current deglaciation period, produced weather patterns which facilitated the advent of domesticating the processes of acquiring food from both flora and fauna; thus, hunter became ranchers and gatherers became farmers.

Since that time humanity has begun to understand the natural world better incrementally leading to employing greater amounts of technology in the production of food. Today the, so called “agri-businesses”, have harnessed the power of this technology to reduce the time required to complete the various elements of production, the amount of energy expended as well as the human labor involved.

These improvements have apparently increased the quality of and length of life for humanity. However, they have come at a cost that is finally being recognized. Pesticides, herbicides and inorganic fertilizers used in the growing process of crops (mainly corn, wheat, soy, etcetera) though allegedly at a ‘safe” level, appear to have debilitating effects over time on those who consume the various derivative product. In addition, the mass processing, leaves the denatured product with little or no nutritional value.

The small-scale farmer by contrast often pursues an organic method or at least a minimum of artificial methods (fertilizers, etc.). In addition, the crops mainly are those providing the most nutrients, as opposed to that which simply offers empty calories. As the small-scale farmer is forced to decrease production the availability of this nutrient dense

produce reduces proportionally and therefore the cost increases. Thus, while the small-scale farmer struggles to survive the less fortunate in our communities must subsist on the inexpensive but nutritionally lacking fare. This might lead to the poor being more likely to deal with obesity and the attendant health issues. Such that, not only do the policies of the Goleta Water District Board seem to oppress the small-scale farmer but, by extension, they oppress the poor.

The story we see in Appendix F, Systems Perspective, is that the larger system elements of the process that brings water to customer of the Goleta Water District are mostly beyond the control of humanity. Human attempts to change the geological, hydrological or meteorological systems are largely ineffective and in the worst cases catastrophic.

The only systems involved that can be readily changed are the human systems; anthropological and political. Anthropologically humanity can, and has, changed behaviors and cultural norms. Generally, cultural elements that negatively impact the majority have been discontinued. However, when an individual or group with apparent power rises to a position of affluence with intentions other than positive for the whole, adverse element may be implemented which might oppress the majority (Satyanath, et al, 2013)

Current awareness of the Goleta Water District customers regarding water scarcity has driven water usage to as much as a 35% decrease in demand. Yet, the knowledge of Goleta Water District policy, though publicly available on their website, is not well known. A cursory sampling of the local residential customers indicates that most are only aware of what they pay on the monthly bill from the Goleta Water District.

The political process phases of legislation development and implementation provides the authoritative documents that help to organize our lives in an equitable manner. However,

if a small and vocal minority of a population can gains power contemporary leadership might, and perhaps have, become like the "Big Men" as described by Fagan. These could then engage in self-aggrandizement (Fagan, 2003). This can also be in the form of favoring a specific constituent subset. Since these are elected officials, it is incumbent upon the voters to seek to govern the governors. Policies, in the case of those at Goleta Water District, would need to be engineered to reasonably distribute the cost of a common community burden.

I do not propose that the Goleta Water District Board and staff are engaged in a hidden plot to drive the small-scale farmer out of business. However, it could be that there is some favoritism toward the majority groups of customers who might be inclined to vote for a board member if they feel that the Goleta Water District is treating them well. The agricultural customers in general, and the small-scale farmers, in particular, would represent the smallest group of potential voters; the least of these, as it were.

All Goleta Water District customers benefit from the efforts of the local agricultural customers. If the financial burden of water cost to the farmer is eased there could be more produce available. This would drive down commodity prices and therefore the cost to the shopper at the grocery store.

It is little known that the farming operations on the borders of the Los Padres National Forest also provide the benefit of a buffer zone against the occasional wildfires thus protecting residential, commercial, and institutional water customers. The nearby cities of Santa Barbara, Montecito and Carpinteria have no such buffer zone of farms. During fires that threatened these cities firefighting crews were hard pressed to protect homes in the foothills. As a result, many lost their property to the flames. By contrast the fires that threaten the Goleta area tend not to encroach upon residential areas. A notable exception was

the “Holiday Fire” of 2018, which started in a residential area adjacent to property owned and farmed by one of our participants.

Apparent limitations to the study are based mainly upon the small number of potential subjects as well as the number who participated. A larger area, such as the whole of Santa Barbara county, might provide different findings. The municipalities in what is known as “the north county”, although growing as suburban communities of Santa Barbara, there is significant agricultural effort. Still, it is likely these farmers, whether small-scale or not, suffered similar experiences as the study’s subject farmers.

Limitations

Also, the community where the subject farms operate is populated with highly affluent residents. This could distort the results if compared to the majority of farms in the United States that meet the requirements of the USDA definition of small-scale. In a community where the predominant source of employment is agriculture, it is possible the farmer and municipal utilities district attitudes would be different.

Summary

What stories do small-scale family farmers, who purchase their irrigation water from the Goleta Water District, tell of the challenges, policies, and issues during conditions of water shortage? These tell of a cascading set of difficulties; reduced precipitation increased the need for artificial irrigation which the Goleta Water District raised the price on during the drought such that in addition to having less produce the cost of growing the crops was higher. This led to the farmers reducing expenditures, both for the farming effort and personal, yet still each began the recovery from the drought in worse condition than they were at the

beginning. Lower cost for Goleta Water District irrigation water would have benefited both the farmers and the community.

How would the small-scale farmer describe the impact of applicable policies, as implemented by the Goleta Water District Board, which deal with Goleta's water shortage challenges? In the worst case the policies of Goleta Water District almost led to a family literally losing the farm. Others were forced to stop using the Goleta Water District water.

Still, perhaps the Goleta Water District can be forgiven, since it only identifies water sources and manages the process of delivery. The Goleta Water District are not rain makers.

REFERENCES

Abascal, J. & Vega, C. (2005). A general purpose model for the condensed phases of water: TIP4P/2005. *The Journal of Chemical Physics, 123*(23), 234505. doi:10.1063/1.2121687

Allégre, C., & Schneider, S. (2005). Evolution of Earth. *Scientific American, 15*(2), 4-13. doi:10.1038/scientificamerican0705-4sp

Alwang, J. & Norton, G., (2011). What types of safety nets would be most efficient and effective for protecting small farmers and the poor against volatile food prices? *Food Security*, #(S1), 139–148., doi:10.1007/s12571-010-0089-9. Retrieved from https://link-springer-com.fgul.idm.oclc.org/article/10.1007%2Fs12571-010-0089-9

Amsalu, A., Beshah, T., & Tafa, K. (2006). Determinants of physical soil and water conservation practices in Ethiopia's semi-arid tropics: The case of Bati District. *Social and Basic Science Research Review*, 2(12), 525-541.

Anderson, M., (2005). *Tending the wild: Native American knowledge and the management of California's natural resources*. Berkeley; University of California Press.

Apple, D., (2001). Evolution of U.S. Water Policy. Toward a Unified Federal Policy. U.S. Forest Service. Retrieved from https://www.fs.fed.us/research/publications/wo/wo_2001_apple_d001.pdf

Ash, C., Hanson, B., & Norman, C. (2002). Earth, air, fire, and water. *Science*, 296(5570), 1055. Retrieved from https://fgul.idm.oclc.org/docview/213567739?accountid=10868

Auerbach, C. F., & Silverstein, L. B. (2003). *Qualitative data: An introduction to coding and analysis*. New York: New York University Press.

Bachman, S. (2011). *Goleta Water District Water Supply Management Plan* (pp. 1-82) (USA, Goleta Water District). Goleta, CA: Goleta Water District. Retrieved from http://www.goletawater.com/assets/documents/water_supply/Water_Supply_Management_Plan_Final_3-31-11.pdf

Bardach, E. (2012). *A practical guide for policy analysis: The eightfold path to more effective problem solving*. Los Angeles: Sage.

Boelhouwer, S. (2017). SB County Public Works Water Resources Mission. Retrieved from http://cosb.countyofsb.org/pwd/pwwater.aspx?id=3602

Burnham, M., Ma, Z., Endter-Wada, J., & Bardsley, T. (2016). Water management decision making in the face of multiple forms of uncertainty and risk. *JAWRA Journal of the*

American Water Resources Association, 52(6), 1366-1384. doi:10.1111/1752-1688.12459, Interview Protocol only. Retrieved from http://repository.iutahepscor.org/storage/f/2015-07-21T13%3A52%3A51.262Z/iutah-interview-protocol-burnham-ma-endter-wada-bardsley-2013.pdf

California Department of Water Resources (2015). *California's most significant droughts: Comparing historical and recent conditions*, Retrieved from https://water.ca.gov/LegacyFiles/waterconditions/docs/California_Signficant_Droughts_2015_small.pdf

California Department of Water Resources (DWR). (2008). *DWRNEWS/CLIMATE CHANGE/Special Edition*. Retrieved from http://www.water.ca.gov/pubs/dwrnews/climate_change_impacts_on_california's_water/climatechange_sc_03__2_.pdf

California Environmental Protection Agency (CalEPA), Central Coast Regional Water Board. (2016). Water quality control plan for the Central Coastal Basin. San Luis Obispo, CA, CALIFORNIA: California Regional Water Quality Control Board, Central Coastal Region.

California Environmental Protection Agency, (1991). About Us. https://calepa.ca.gov/about/

California State Assembly Committee on Water. (1972). State policy regarding the provision of water supplies within the Sacramento-San Joaquin Delta, The Operation of the State Water Resources Development System, and the Allocation of Costs for Project Benefits (AB2212). Sacramento, CA: California State Assembly Committee on Water.

California State Water Resources Control Board, (2015). Safe Drinking Water Plan for California. Retreived from https://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf

California Water Plan. (1987, September 23). Retrieved January 17, 2016, from http://www.waterplan.water.ca.gov/docs/previous/annualreports/1987_annual_report.pdf

Cavalcanti, I. & Kousky, V., 2001. Drought in Brazil during summer and fall 2001 and associated atmospheric circulation features. *Center of Climate Prediction, National Centers Environmental Prediction*. Retrieved from http://climanalise.cptec.inpe.br/~rclimanl/revista/pdf/criseing.pdf

Central Coast Regional Water Board (2016).

Central Coast Regional Water Board. (2012). Water Quality Control Policy for Siting, Design, Operation, and Maintenance of onsite Wastewater Treatment Systems

(OWTS Policy). Sacremento, California. Retrieved from https://www.waterboards.ca.gov/water_issues/programs/owts/board_adopted_policy.html

City of Goleta. (2018). About Goleta. Goleta, CA, Retrieved from www.cityofgoleta.org/community/about-goleta

Cleveland, D. (2014). *Balancing on a planet: The future of food and agriculture*. Berkeley and Los Angeles, CA. University of California Press.

Corvalan, Hales, & McMichael, (2005). Ecosystems and human well-being: health synthesis, available from https://apps.who.int/iris/bitstream/handle/10665/43354/9241563095.pdf

Devereux, S. (2000). Famine in the Twentieth Century. IDS Working Paper 105. *Institute of Development Studies, 2000*. Retrieved from https://opendocs.ids.ac.uk/opendocs/handle/123456789/3435

Dror, Y. (1969). *Policy analysis: A theoretic framework and some basic concepts*. Santa Monica, CA: RAND Corporation.

Drummond, J., & Barros-Platiau, A. (2006). Brazilian environmental laws and policies, 1934–2002: A critical overview. *Law and Policy*, 28(1), 83-108. Retrieved from http://papers.ssrn.com/sol3/DisplayAbstractSearch.cfm

Escobar, H. (2015). Drought triggers alarms in Brazil's biggest metropolis. *Science*, 347(6224), 812. Retrieved from http://www.sciencemag.org/content/347/6224/812

Fagan, B. (2003). *Before California: An archaeologist looks at our earliest inhabitants*. Walnut Creek, CA: Rowman & Littlefield.

Fagan, B. M. (2004). *Before California: An archaeologist looks at our earliest inhabitants*. Walnut Creek, CA: Altamira Press.

Galloway, D., Jones, D., & Ingebritsen, S. (2000, Winter). Land subsidence in the United States, Section 6, pp. 23-34 (United States, US Department of Interior, USGS). Retrieved January 18, 2016, from http://pubs.usgs.gov/circ/circ1182/pdf/06SanJoaquinValley.pdf

Gamble, L. (2005). Culture and climate: Reconsidering the effect of palaeoclimatic variability among Southern California hunter-gatherer societies, *World Archaeology*, 37(1), 92-108. DOI: 10.1080/0043824042000329586 Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.565.1361&rep=rep1&type=pdf

General Assembly (UN). (1948, December 10). Resolution 217 A, *Universal Declaration of Human Rights, Article 25*. Available from https://www.ohchr.org/EN/UDHR/Documents/UDHR_Translations/eng.pdf

General Assembly (UN). (30 August 2010). Resolution 64/292, *The human right to water and sanitation*, A/RES/64/292. Available from http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/64/292

German, D. (2005, May 30). Why do we do this to ourselves? Retrieved from https://dennispgerman.com/secular/why.pdf

Giannikopoulou, A. S., Gad, F. K., Kampragou, E., & Assimacopoulos, D. (2017). Risk-based assessment of drought mitigation options: The case of Syros Island, Greece. *Water Resources Management*, 31(2), 655-669. Retrieved from https://search-proquest-com.fgul.idm.oclc.org/docview/1982519702?pq-origsite=summon&https://search.proquest.com/abicomplete

Glassow, M., Gamble, L., Perry, J. & Russell, G. (2010). Prehistory of the Northern California Bight and the adjacent transverse ranges. In T. Jones, & K. Klar (Eds) *California prehistory: Colonization, culture and complexity* (pp.193-214). Plymouth, UK: AltaMira Press.

Glazer, A. N., & Likens, G. E. (2012). The water table: The shifting foundation of life on land. *Ambio*, 41 (7), 657-69. doi:http://dx.doi.org.fgul.idm.oclc.org/10.1007/s13280-012-0328-8. Retrieved from https://search-proquest-com.fgul.idm.oclc.org/docview/1112137008?pq-origsite=summon&https://search.proquest.com/abicomplete

Gleick, p. (1996). Basic water requirements for human activities: Meeting basic needs. *Water International*, *21*(2), 83-92. Retrieved from http://pacinst.org/wp-content/uploads/2012/10/basic_water_requirements-1996.pdf

Gleick, p. (1999). The human right to water. *Water Policy*, 1(5), 487-503. Retrieved from http://pacinst.org/wp-content/uploads/sites/21/2012/10/basic_water_needs_human_right_to_water.pdf

Goleta Water District (2017, May). Goleta Water District Water Supply Management Plan http://www.goletawater.com/assets/uploads/WSMP%202015%20Update_FINAL_May%202017.pdf

Goleta Water District, (2017, January). What We Do. Retrieved 2017, January, from http://www.goletawater.com/about-the-district/what-we-do

Goleta Water District. (2006). Goleta Water District Water Code. Retrieved from http://www.goletawater.com/assets/documents/other/Goleta Water District_Water_Code_0720.pdf

Goleta Water District. (2010, February 5). Goleta Water District building earns LEED Gold Certification. [Press Release]. Retrieved from http://www.goletawater.com/pressreleases/PRESS_RELEASE_FEB._5_2010.pdf

Goleta Water District. (2012, June). Sustainability. Retrieved from http://www.goletawater.com/assets/uploads/documents/conservation/Sustainability%20Plan%20FINAL%20120613.pdf

Goleta Water District. (2014, July). Drought preparedness and water shortage contingency plan. Retrieved from http://www.goletawater.com/assets/uploads/documents/FINAL%20GWD%20Drought%20Management%20Plan%20July%202014.pdf

Goleta Water District. (2014, October). Temporary denial of new service applications. Retrieved from http://www.goletawater.com/rates-bills-and-budget/new-water-services/temporary-denial-of-new-service-applications

Goleta Water District. (2014, September). Stage II Water Shortage Emergency Information. Retrieved from http://www.goletawater.com/newsletters-and-press/featured-story/stage-ii-water-shortage/

Goleta Water District. (2015 December). A multi-year effort to protect and extend water supplies. Retrieved from http://www.goletawater.com/newsletters-and-press/featured-story/drought-planning-article/

Goleta Water District. (2015). Stage III Water Shortage Emergency Information. Retrieved from http://www.goletawater.com/newsletters-and-press/featured-story/stage-iii-water-shortage-emergency-information/

Goleta Water District. (2017, June). Comprehensive Annual Financial Report. Retrieved from http://www.goletawater.com/assets/uploads/GWD%20CAFR%202017%20Final.pdf

~~Goleta Water District. (2018 Spring). Sustainability. Retrieved from http://www.goletawater.com/conservation/sustainability~~

~~Goleta Water District. (2018a). Drought update. Retrieved from http://www.goletawater.com/summer-drought-update~~

Goleta Water District. (2018b). Stage III water shortage emergency information. Retrieved from www.goletawater.com/newsletters-and-press/featured-story/stage-iii-water-shortage-emergency-information

Goleta Water District. (2018c). Urban agricultural drought portal. Retrieved from http://www.goletawater.com/drought-portals/urbanagdroughtportal

Goleta Water District. (2018d). Comprehensive Annual Financial Report. Retrieved from http://www.goletawater.com/assets/uploads/GWD%20CAFR%202018%20Final.pdf

Goleta Water District. (2019 February). Free agricultural water conservation checkups Retrieved from http://www.goletawater.com/conservation/agricultural

Goleta Water District. (2019 January). Board of Directors. Retrieved from http://www.goletawater.com/about-the-district/board-of-directors

Goleta Water District. (2019). Stage I water shortage information. Retrieved from https://www.goletawater.com/stage-i-water-shortage-emergency-information

Goleta Water District. (2019, April). Standards & Specifications or he Construction of Water Facilities - June 2019. Retrieved from http://www.goletawater.com/assets/uploads/2019_June_GWD_Standards__Specifications.pdf

Goleta Water District. (2019, December). Goleta Water District Water Code. Retrieved from http://www.goletawater.com/assets/uploads/documents/other/Goleta Water District_Water_Code_010118.pdf

Goleta Water District. (2019, Summer). Water Features: Goleta Water District News – Summer 2019. Retrieved from http://www.goletawater.com/newsletters/GWD_News_Summer_2019_Final_WEB.pdf

Goleta Water District. (2019, Winter). Water Features: Goleta Water District News – Winter 2019. Retrieved from http://www.goletawater.com/newsletters/GWD_News_Winter_2019_FNLwebL.pdf

Goleta Water District. (2020a). Facts and figures. Retrieved from http://www.goletawater.com/about-the-district/facts-and-figures

Goleta Water District. (2020b). Water supply. Retrieved from http://www.goletawater.com/water-supply/

Guba, E. G. (1984, October). The effect of definitions of policy on the nature and outcomes of policy Analysis. *Educational Leadership*, 42(2), 63-70.

Haas, L. (1995). *Conquests and historical identities in California*, 1769-1936. Berkeley: University of California Press.

Hanak, E., Lund, J., Dinar, A., Gray, B., Howitt, R., Mount, J., Moyle, P. & Thompson, B. (2011). Orchestrating the management of water scarcity, quality, and flooding. In managing California's water: From conflict to reconciliation. San Francisco, CA: California: Public Policy Institute of California. Retrieved from http://www.ppic.org/content/pubs/report/R_211EHR.pdf

Hawking, S. (1988). *A brief history of time: From the big bang to black holes*. Toronto: Bantam Books.

Henry, C. (2009). Uplift of the Sierra Nevada, California. *Geology, 37*(6), 575-576. doi:10.1130/focus062009.1

HIV.gov (2018). Global Statistics. Retrieved from https://www.hiv.gov/hiv-basics/overview/data-and-trends/global-statistics

Howard, G. & Bartram, J. (2003). Domestic water quantity, service level and health. Geneva, Switzerland: World Health Organization. http://www.who.int/water_sanitation_health/diseases/WSH03.02.pdf

Hughes, M. & Brown, P. (1992). Drought frequency in central California since 101 B.C. recorded in giant sequoia tree rings. *Climate Dynamics* 6, 161–167. Retrieved from https://doi.org/10.1007/BF00193528

Hundley, N. (1992). The great thirst: Californians and water, 1770s-1990s. Berkeley: University of California Press.

Hutton, W. (1906). *William Stubbs, bishop of Oxford, 1825-1901: (From the letters of William Stubbs)*. London, UK: Archibald Constable.

Ingram, B. L., & Malamud-Roam, F. (2013). The West without water: What past floods, droughts, and other climatic clues tell us about tomorrow. Berkeley: University of California Press.

Ingram, B. & Malamud-Roam, F. (2013). The West without water: What past floods, droughts, and other climatic clues tell us about tomorrow. Berkeley: University of California Press.

Jara-Rojas, R., Bravo-Uretaab, B., Englera, A., Díaza, J. (2012). "An analysis of the joint adoption of water conservation and soil conservation in Central Chile." Land Use Policy, vol. 32, 2013, pp. 292–301., doi:10.1016/j.landusepol.2012.11.001

Johnson, S. K. (2014, February 7). Plate tectonics set the thermostat for early animal life. Retrieved April 25, 2016, from http://arstechnica.com/science/2014/02/plate-tectonics-set-the-thermostat-for-early-animal-life/

Johnson, S. K. (2016). A recipe for global cooling—put seafloor on dry land near the equator. Retrieved August 9, 2016, from http://arstechnica.com/science/2016/04/a-recipe-for-global-cooling-put-seafloor-on-dry-land-near-the-equator/

Johnsson, R., & Kemper, K. (2005, June). Institutional and policy analysis of river basin management : The Alto-Tiete river basin, Sao Paulo, Brazil (World Bank Policy Research Working Paper 3650). Washington, DC: World Bank. Retrieved from http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-3650

1748 Johnston-Dodds, K. (2009) Early California Laws and Policies Related to California Indians.
1749 Sacramento, California Research Bureau

1750 Kennedy/Jenks Consultants (2014), 2014 Drought Preparedness and Water Shortage
1751 Contingency Plan
1752 http://www.goletawater.com/assets/uploads/documents/FINAL%20GWD%20Drough
1753 t%20Management%20Plan%20July%202014.pdf

1754 Kennedy/Jenks Consultants. (2010). The 2010 urban water management plan. Retrieved from
1755 http://www.goletawater.com/assets/Goleta Water District_2010UWMP_Final.pdf

1756 Kesseli, J. (1942). "The Climates of California According to the Köppen Classification".
1757 *Geographical Review*. 32 (3): 476–480.

1758 Kleiner, S., (1999). Water: An essential but overlooked nutrient. *Journal of the American*
1759 *Dietietic Association*, 99 (2); 200-206. Retrieved from
1760 https://www.researchgate.net/publication/13317493_Water_An_Essential_But_Overl
1761 ooked_Nutrient

1762 Kleman, J., Fastook, J., Ebertr, K., Nilsson, K., & Caballero, R. (2013, September 10). Pre-
1763 Last glacial maximum Northern Hemisphere ice sheet topography. Retrieved April
1764 10, 2016, from http://www.clim-past.net/

1765 Konner, M. & Eaton, S. (2010). Nutrition in clinical practice. *Paleolithic Nutrition*. 25; 594–
1766 602. doi:10.1177/0884533610385702

1767 Kummu, M., Ward, P., Moel, H., & Varis, O. (2010). Is physical water scarcity a new
1768 phenomenon? Global assessment of water shortage over the last two millennia.
1769 *Environmental Research Letters*, 5 (034006), 1-10. Retrieved March 7, 2015, from
1770 http://iopscience.iop.org/1748-9326/5/3/034006

1771 Lord, L. (1997, August 18-25) How many people were here before Columbus? *U.S. News &*
1772 *World Report*, pp. 68-70.

1773 Luthi, D., Le Floch, M., Bereiter, B., Blunier, T., Barnola, J.-M., Siegenthaler, U., . . .
1774 Stocker, T. F. (2008). High-resolution carbon dioxide concentration record
1775 650,000-800,000 years before present. Nature, 453 (7193), 379-382.
1776 doi:10.1038/nature06949

1777 MacDonald, J. M., Korb, P. & Hoppe, R. A. (2013 August). Farm size and the
1778 organization of U.S. crop farming. *US, USDA, Economic Research Service*.
1779 Retrieved from
1780 https://www.ers.usda.gov/webdocs/publications/45108/39359_err152.pdf?v=4152

1781 Macko, S. A., Engel, M. H., Andrusevich, V., Lubec, G., O'Connell, T. C., & Hedges, R.
1782 E. (1999). Documenting the diet in ancient human populations through stable
1783 isotope analysis of hair. *Philosophical Transactions of the Royal Society;* of London.

Series B, 354 (1379), 65–76. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1692445/pdf/10091248.pdf

Meadows, D. H., & Wright, D. (2008). *Thinking in systems: A primer*. White River Junction, VT: Chelsea Green.

Milly, P., Betancourt, J., Falkenmark, M., Kundzewicz, Z., Lettenmaier, D., & Stouffer, R. (2008). Stationarity is dead: Whither water management? *Science*, 319 (5863), 573-574. Retrieved from http://www.sciencemag.org/content/319/5863/573.summary

Moratto, M. (1984). *California archeology*. Salinas, CA, Coyote Press.

Mount, J. & Hanak, E. (2016). Just the facts: Water use in California. Public Policy Institute of California.

Murtinho, F., Tague, C., de Bievre, B., Eakin, H. & Lopez-carr, D. (2013). Water scarcity in the Andes- A comparison of local perceptions and observed climate land use and socioeconomic changes. *Human Ecology*; 41 (5), 667-681. DOI:10.1007/s10745-013-9590-z. Retrieved from https://search-proquest-com.fgul.idm.oclc.org/docview/1439577852?pq-origsite=summon&accountid=10868

Oreskes, N. (2004). Beyond the ivory tower: The scientific consensus on climate change. *Science*, 306 (5702), 1686-1686. doi:10.1126/science.1103618. Retrieved from http://science.sciencemag.org/content/306/5702/1686/tab-pdf

Padgham, J., (2009). Agricultural development under a changing climate: Opportunities and challenges for adaptation. Washington, DC: World Bank.

Penn, J. (2001). *Rivers of the World*. Santa Barbara, CA: ABC-CLIO, LLC.

PPIC Water Policy Center. PPIC Water Policy Center. Public Policy Institute of California. Web. 10 Mar. 2016. <http://www.ppic.org/water/>.

Price, T. D. (2007). *Europe's first farmers*. Cambridge, UK: Cambridge University Press.

Richards, M. (2002). A brief review of the archaeological evidence for Paleolithic and Neolithic subsistence. *European Journal of Clinical Nutrition*; 56 (12), 1270-1278. Retrieved from https://search-proquest-com.fgul.idm.oclc.org/docview/219657812?pq-origsite=summon&accountid=10868

Roco, L., Poblete, D., Meza, F., & Kerrigan, G. (2013). Farmers' options to address water scarcity in a changing climate: Case studies from two basins in Mediterranean Chile. Environmental Management, 58(6), 958-971. http://dx.doi.org.fgul.idm.oclc.org/10.1007/s00267-016-0759-2 Retrieved from https://fgul.idm.oclc.org/docview/1833158696?accountid=10868

Rohling, E. J., Hibbert, F. D., Grant, K. M., Galaasen, E. V., Irvalı, N., Kleiven, H. F., … Yu, J. (2019). Asynchronous Antarctic and Greenland ice-volume contributions to the last interglacial sea-level highstand. *Nature Communications*, *10*(1). doi: 10.1038/s41467-019-12874-3. Retrieved from https://www.nature.com/articles/s41467-019-12874-3#citeas

San Joaquin Valley Water Infrastructure Authority (SJVWIA). (2015). Joint Exercise Of Powers Agreement Creating The San Joaquin Valley Water Infrastructure Authority. San Joaquin Valley, California, USA.

Sánchez-Jankowski, M. (2018). Introduction. *Ethnography*, *19*(2), 149–152. Retrieved from https://journals.sagepub.com/toc/eth/19/2

Santa Barbara County - Flood Control District. (2016 October). Santa Barbara County Hydrology Report. Retrieved from https://www.countyofsb.org/uploadedFiles/pwd/Content/Water/Documents/2016%20Hydrology%20Report.pdf

Santa Barbara County – Flood Control District. (2016). Rainfall and reservoir summary. Retrieved from http://cosb.countyofsb.org/uploadedFiles/pwd/Water/Hydrology/rainfallreport.pdf

Santa Barbara Water Resources, (2013). Integrated Regional Water Management Program. https://www.countyofsb.org/pwd/water/irwmp/plan-2019.sbc

Satyanath, S., Voigtlaender, N., & Voth, H.-J. (2013). *Bowling for fascism: Social capital and the rise of the Nazi Party in Weimar Germany, 1919-33*. Cambridge, MA: National Bureau of Economic Research. doi: https://doi.org/10.1086/690949. Retrieved from https://www.journals.uchicago.edu/doi/abs/10.1086/690949?journalCode=jpe

Shakun, J. , Clark, U., He, F., Marcott, S., Mix, A., Liu, Z., . . . Bard, E. (2012). Global warming preceded by increasing carbon dioxide concentrations during the last deglaciation. *Nature, 484* (7392), 49-54. Retrieved from https://fgul.idm.oclc.org/docview/1012159509?accountid=10868

Sheffield, J., Wood, E. F., & Roderick, M. L. (2012). Little change in global drought over the past 60 years. *Nature, 491* (7424), 435-8. Retrieved from https://fgul.idm.oclc.org/docview/1223498983?accountid=10868

Skonieczny, C., Paillou, P., Bory, A., Bayon, G., Biscara, L., Crosta, X., . . . Grousset, F. (2015). African humid periods triggered the reactivation of a large river system in Western Sahara. *Nature Communications 6*, 8751. doi:10.1038/ncomms9751

Solomon, S. (2010). *Water: The epic struggle for wealth, power and civilization*. London, UK; Harper Collins.

Spada, G., Bamber, J., & Hurkmans, R. (2013, February 13). The gravitationally consistent sea-level fingerprint of future terrestrial ice loss. *Geophysical Research Letters, 40*, 482-486. doi:10.1002/(issn)1944-8007

State of California, Office of Governor Governor Edmund G. Brown Jr., (2014, January 17). *Governor Brown declares drought state of emergency*. Retrieved from www.gov.ca.gov/2014/01/17/news18368/

State Water Resource Control Board, (1990). *Pollutant policy document: San Francisco Bay/Sacramento - San Joaquin delta estuary*. Sacramento, CA: State Water Resource Control Board.

State Water Resources Control Board (2010). Policy for maintaining instream flows in northern California coastal streams draft. Sacramento, CA: State Water Resources Control Board, California Environmental Protection Agency.

State Water Resources Control Board (2016, March 1). Plans and policies. Retrieved from http://www.swrcb.ca.gov/plans_policies/

Steduto, p., Hsiao, T., Fereres, E. & Raes, D. (2012). Crop yield response to water. *Food and Agriculture Organization of The United Nations*. Retrieved from http://www.fao.org/docrep/016/i2800e/i2800e.pdf

Stolhandske, S, Evans, T. (2017). On the bleeding edge of farming the city: An ethnographic study of small-scale commercial urban farming in Vancouver, *Journal of Agriculture, Food Systems, and Community Development*. 7 (2), 29-49. Retrieved from https://www.foodsystemsjournal.org/index.php/fsj/article/view/508

Stumbos, J. (1993). Small farmers: Who are they and why do they matter? *California Agriculture,* 47(2), 6-7. Retrieved from http://calag.ucanr.edu/archive/?article=ca.v047n02p6

Taher, T. (2016, September). Groundwater abstraction management in Sana'a Basin, Yemen: a local community approach. *Hydrogeology Journal*, 24 (6), 1593–1605. Retrieved from https://tinyurl.com/ya3zel6b (tiny URL)

Thompson, B. (1993). Institutional perspectives on water policy and markets. *California Law Review*, 81(3), 671-764. doi:10.15417/1881

U.S. Geological Survey (USGS), (July 7, 2015). California's Central Valley, Retrieved August 06, 2016, from http://ca.water.usgs.gov/projects/central-valley/about-central-valley.html

United States Census Bureau. (n.d.). Bibliography. Retrieved, from United States Census Bureau, census.gov

United States Department of Agriculture. USDA Economic Research Service. (2013). USDA small farm definitions. Retrieved from www.articles.extension.org/pages/13823/usda-small-farm-definitions#.UsV_8ifCYx4

United States Department of Commerce. Bureau of Economic Analysis. (2018). Bear Facts. Retrieved from www.bea.gov/regional/bearfacts/pdf.cfm?fips=06000&areatype=STATE&geotype=3

UN-Water (2017). Policy Briefs. Retrieved from https://www.unwater.org/example-of-activity/policy-briefs/

USDA (2015 January). Census of Agriculture (Vol. 2, Ser. 10) (USA, USDA, National Agricultural Statistics Service). U.S. Department of Agriculture. Retrieved from https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Typology/typology13.pdf

USGS (2013). "Droughts, climate change, and ground-water sustainability." *Sustainability of Ground-Water Resources*--Circular 1186, U.S. Geological Survey, Retrieved from https://pubs.usgs.gov/circ/circ1186/html/boxb.html.

Veblen, T., Baker, W., Montenegro, G. & Swetnam, T. (2003). Fire and climatic change in temperate ecosystems of the western Americas. New York: Springer. doi:10.1.1.570, Retrieved from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.570.7173&rep=rep1&type=pdf

World Health Organization. (2003). The right to water. Retrieved from https://www2.ohchr.org/english/issues/water/docs/Right_to_Water.pdf

Zenovich, M. (director). (2017) *Water and power: A California heist* [Netflix]. National Geographic, http://www.channel.nationalgeographic.com/water-and-power-a-california-heist

APPENDIX A - CONSENT FORM

Fielding Graduate University

Goleta Water District Drought Policy Impact on Small Scale Farmers

NAME OF SUBJECT:_____

You have been asked to participate in a research study conducted by Dennis P. German, a doctoral student in the School of Leadership Studies at Fielding Graduate University, Santa Barbara, CA. This study is supervised by Annabelle Nelson, PhD. This research involves the study of water policy impact on the small-scale family farms of Goleta, California and is part of Dennis's Fielding dissertation. You are being asked to participate in this study because of your being one of the few small-scale family farmers in Goleta.

Before you agree to participate in this research study, it is important that you read and understand the information provided in this Informed Consent Form. If you have any questions, please ask the researcher for clarification.

Why Is This Study Being Done?

The purpose of this research is to allow the small-scale family farmers to tell their stories about coping with conditions of water scarcity and dealing with the Goleta Water District.

How Many People Will Take Part in The Study?

Several (5-7) local small-scale family farmers who are customers of the Goleta Water District and 1 or 2 members of the Goleta Water District Board.

What Is Involved in The Study?

If you agree to participate in this study, you will *answer simple questions about your experience during the drought and with the Goleta Water District. You will have the opportunity to speak openly and at length about your experience*.

How Long Will I Be in The Study?

The study involves an interview, to be arranged at your convenience. This will last approximately 60 minutes or more depending upon your desire to speak on the subject. The total time involved in participation will be approximately no more than an hour.

What Are the Risks of The Study?

The risks to you are considered minimal and there is a chance you may experience various emotions during or after your participation as you reflect on your experiences or increase your self-awareness about your realities. The main risk of this study is protecting your confidentiality, which the researcher will do by coding your identity unless you are comfortable revealing your identity after the study. Your identity will be coded from the beginning of any digital recordings to when the data from the study is analyzed and documented in any form. You will be informed of what your coded identity is. The additional risk is the use of your time during your routine working day. To mitigate this risk, the researcher will meet with you when it is convenient for you and does not disrupt your business arrangements, production or profitability.

New Findings:

If, during this study, significant new information becomes available that may relate to your willingness to continue to participate, this information will be provided to you by the researcher.

What about Confidentiality and Protection?

Study related records will be held in confidence. Your consent to participate in this study includes consent for the researcher, supervising faculty who may also see your data. Your research records may also be inspected by authorized representatives of the Fielding Graduate University, including members of the Institutional Review Board or their designees. They may inspect, and photocopy as needed, your records for study monitoring or auditing purposes. In addition, parts of your record may be photocopied.

The information you provide will be kept strictly confidential. The informed consent forms and other identifying information will be kept separate from the data. All materials, including recordings, will be kept on the hard drive of the researchers laptop clearly marked confidential dissertation research. “The tape recordings will be listened to only by the Researcher and possibly but not necessarily the Researcher’s faculty supervision to include Dissertation Committee members and external reader) Any records that would identify you as a participant in this study, such as informed consent forms, will be destroyed by September 2021 approximately three years after the study is completed.

The results of this research will be published in my dissertation and possibly published in subsequent journals, books or presentations

The security of data transmitted over the Internet cannot be guaranteed, therefore, there is a slight risk that the information you send to me via email will not be secure. The collection of such data is not expected to present any greater risk than you would encounter in everyday life when sending and/or receiving information over the Internet.

Participation in Research Is Voluntary:

You are free to decline to participate or to withdraw from this study at any time, either during or after your participation, without negative consequences. Should you withdraw, your data will be eliminated from the study and will be destroyed. The researcher is also free to terminate the study at any time.

Compensation:

No compensation will be provided for participation.

Study Results:

You may request a copy of the summary of the aggregate final results by indicating your interest at the end of this form.

Additional Information:

If you have any questions about any aspect of this study or your involvement, please tell the Researcher before signing this form. You may also contact the supervising faculty if you have questions or concerns about your participation in this study. The supervising faculty has provided contact information at the bottom of this form.

You may also ask questions at any time during your participation in this study.

If at any time you have questions or concerns about your rights as a research participant, contact the Fielding Graduate University IRB by email at irb@fielding.edu or by telephone at 805-898-4034.

Two copies of this informed consent form have been provided. Please sign both, indicating you have read, understood, and agree to participate in this research. Return one to the researcher and keep the other for your files. The Institutional Review Board of Fielding Graduate University retains the right to access to all signed informed consent forms.

I have read the above informed consent document and have had the opportunity to ask questions about this study. I have been told my rights as a research participant, and I voluntarily consent to participate in this study. By signing this form, I agree to participate in this research study. I shall receive a signed and dated copy of this consent.

_____

NAME OF PARTICIPANT (please print)

_____

SIGNATURE OF PARTICIPANT

_____

DATE

Annabelle Nelson, PhD
anelson@fielding.edu

Fielding Graduate University
2020 De La Vina Street
Santa Barbara, CA 93105-3814
805-687-1099

Dennis P. German
dgerman@email.fielding.edu

PO Box 282
Goleta, CA 93116-0282

805-364-4316

Yes, please send a summary of the study results to the email address or postal address (optional) provided below:

_____ _____

NAME (please print) Email Address (please print)

_____

Street Address

_____

City, State, Zip

APPENDIX B.1 - RECRUITMENT LETTER (FARMER)

<<Date>>

<<Name of potential participant>>

<<Address>>

<<City, State, Zip>>

Re: *Goleta Water District Drought Policy Impact on Small Scale Farmers*

Dear *<<insert name>>*:

I am writing to let you know about an opportunity to participate in a research study about water issues and drought policy in Goleta. This study is being conducted by Dennis P. German at Fielding Graduate University in Santa Barbara. This study will allow the small-scale family farmers to tell their stories about coping with conditions of water scarcity and dealing with the Goleta Water District.

Your use of pesticides in your farming/ranching operation requires the listing of your contact information with the County agricultural commission. We are writing to tell you that we believe you may meet the subject requirements of an approved research study about Goleta Water District drought policy impact on small scale farmers.

Agreement to be contacted or a request for more information does not obligate you to participate in any study.

If you would like additional information about this study, please call Dennis P. German at 805-364-4316.

Thank you again for considering this research opportunity.

APPENDIX B.2 - RECRUITMENT LETTER (GOLETA WATER DISTRICT BOARD MEMBER)

<<Date>>

**<<Name of potential participant>>*

<<Address>>

<<City, State, Zip>>

Re: *Goleta Water District Drought Policy Impact on Small Scale Farmers*

Dear *<<insert name>>*:

I am writing to let you know about an opportunity to participate in a research study about water issues and drought policy in Goleta. This study is being conducted by Dennis P. German at Fielding Graduate University in Santa Barbara. This study will allow the small-scale family farmers to tell their stories about coping with conditions of water scarcity and dealing with the Goleta Water District.

Your membership on the Goleta Water District board of directors brings a perspective which we wish to include in an approved research study about Goleta Water District drought policy impact on small scale farmers.

Agreement to be contacted or a request for more information does not obligate you to participate in any study.

If you would like additional information about this study, please call Dennis P. German at 805-364-4316.

Thank you again for considering this research opportunity.

APPENDIX C.1 - INTERVIEW PROTOCOL (FARMER)

Interviewer:
Interviewee:
Date of interview:
Location of interview:

Crop Farmers

Thanks for taking the time to talk to me. I am a PhD candidate at Fielding Graduate University studying the impacts of the drought on Goleta's local family farms. The research will show how you have fared with the policies that the Goleta Water District implements during drought condition. During the interview, I'd like to discuss with you the challenges you face; how you have dealt with droughts in the past and how you expect to deal with droughts in the future. This interview should take about 60 minutes. Everything you tell me during the interview will be kept strictly confidential and your name and the location of your farm/ranch will not be revealed to anyone beyond my research team. For data coding and analysis, it will be helpful for me to record this conversation. Do you feel comfortable with this? If not, please let me know now. Again, thank you for your willingness to participate in this interview. Unless you have any questions, let's go ahead and get started.

SECTION 1: BACKGROUND ON INTERVIEWEE AND ORGANIZATION

To begin, I'd like to ask a few questions about your role at [organization] and some of the basic management challenges your organization faces.

2. I read on your website that you [do the following] here at [organization].
    a. Is this still your major responsibility?

b. Is there anything else you are responsible for managing and making decisions about?

3. What are the most pressing management challenges your organization faces?

   a. What are the year-to-year, short-term planning challenges faced by your organization?

   b. What are the five-to-ten-year, long-term planning challenges faced by your organization?

   c. Among these management challenges, which are considered top priorities for your organization to address?

   d. How does Goleta's population growth and the expected rise in municipal water demand impact your organization's planning and decision-making?

   e. How does providing agricultural water fit into your organization's priorities and management challenges?

4. How does [organization] work with other local, state, and federal agencies to address the challenges we just talked about facing your organization? If not, what prevents your organization from working collaboratively with other agencies?

SECTION 2: DROUGHT PREPAREDNESS

Next, I'd like to ask some questions about how you and your organization have managed drought in the past and what lessons for the future you have learned from those experiences.

1. What have you and your organization learned about dealing with drought from previous experiences?

   a. What are the tradeoffs you must make during droughts?

   b. How do you prioritize those tradeoffs?

   c. What has your organization done to deal with previous droughts that has prepared you for future droughts?

d. What do you wish your organization could be doing to better deal with drought?

e. What prevents your organization from doing this?

f. How does water for agricultural uses fit into your drought management strategies?

g. What concern do you have about your organization's capacity to deal with future droughts and water scarcity?

h. What is the threshold that needs to be crossed for a drought to become an unmanageable emergency?

i. In your opinion, how many consecutive years of drought can your organization handle given your current capacity and resources?

j. How do droughts affect your organization's interaction with other local, state, and federal agencies?

k. What enables you to work effectively across agencies in times of drought?

What prevents you from being able to work effectively across agencies in times of drought?

APPENDIX C.2 - INTERVIEW PROTOCOL (GOLETA WATER DISTRICT BOARD MEMBER)

Interviewer:
Interviewee:
Date of interview:
Location of interview:

Goleta Water District Board Member

Thanks for taking the time to talk to me. I am a PhD candidate at Fielding Graduate University studying the impacts of the drought on Goleta's local family farms. The research will show how you have fared with the policies that the Goleta Water District implements during drought condition. During the interview, I'd like to discuss with you the challenges you face; how you have dealt with drought in the past and how you expect to deal with droughts in the future. This interview should take about 60 minutes. Everything you tell me during the interview will be kept strictly confidential and your name and the location of your farm/ranch will not be revealed to anyone beyond my research team. For data coding and analysis, it will be helpful for me to record this conversation. Do you feel comfortable with this? If not, please let me know now. Again, thank you for your willingness to participate in this interview. Unless you have any questions, let's go ahead and get started.

SECTION 1: BACKGROUND ON INTERVIEWEE AND ORGANIZATION

To begin, I'd like to ask a few questions about your role at [organization] and some of the basic management challenges your organization faces.

5. I read on your website that you [do the following] here at [organization].

   c. Is this still your major responsibility?

d. Is there anything else you are responsible for managing and making decisions about?

6. What are the most pressing management challenges your organization faces?

    a. What are the year-to-year, short-term planning challenges faced by your organization?

    b. What are the five-to-ten-year, long-term planning challenges faced by your organization?

    c. Among these management challenges, which are considered top priorities for your organization to address?

    d. How does Goleta's population growth and the expected rise in municipal water demand impact your organization's planning and decision-making?

    e. How does providing agricultural water fit into your organization's priorities and management challenges?

7. How does [organization] work with other local, state, and federal agencies to address the challenges we just talked about facing your organization? If not, what prevents your organization from working collaboratively with other agencies?

SECTION 2: DROUGHT PREPAREDNESS

Next, I'd like to ask some questions about how you and your organization have managed drought in the past and what lessons for the future you have learned from those experiences.

2. What have you and your organization learned about dealing with drought from previous experiences?

    a. What are the tradeoffs you must make during droughts?

    b. How do you prioritize those tradeoffs?

    c. What has your organization done to deal with previous droughts that has prepared you for future droughts?

    d. What do you wish your organization could be doing to better deal with drought?

e. What prevents your organization from doing this?

f. How does water for agricultural uses fit into your drought management strategies?

g. What concern do you have about your organization's capacity to deal with future droughts and water scarcity?

h. What is the threshold that needs to be crossed for a drought to become an unmanageable emergency?

i. In your opinion, how many consecutive years of drought can your organization handle given your current capacity and resources?

j. How do droughts affect your organization's interaction with other local, state, and federal agencies?

k. What enables you to work effectively across agencies in times of drought?

l. What prevents you from being able to work effectively across agencies in times of drought?

SECTION 3: PLANNING FOR CHANGE

Going forward, climate and other hydrological, ecological, and social changes may have an impact on your organization's ability to manage water. Now, I'd like to talk a little more about how your organization is planning with respect to the different changes that are occurring in the Goleta area.

22221. What is the nature of the discussion within your organization about climate change?

22232. What is your organization doing to manage and plan for climate change?

a. If nothing, what prevents your organization from doing anything?

b. What do you wish your organization were doing to address the potential impacts of climate change, which for this region have been predicted to be increased frequency, severity and duration of drought, reduced water availability, and changes in precipitation patterns?

22293. What are the biggest barriers for your organization to adapt to climate change?

4. What needs to happen for your organization to more effectively manage and plan for climate change?

    a. What information would help your organization make decisions?

    b. What types of collaboration with the research community or other local, state, and federal agencies would help your organization?

    c. What policy changes or actions by the state legislature would you like to see?

    d. What institutional changes would you like to see?

    e. What infrastructural changes would you like to see?

    f. Is the current built infrastructure managed by your organization set up to deal with shifts in precipitation from snow to rain and earlier spring runoff?

5. In your opinion, how does climate change create new management and planning challenges for your organization?

    a. Given that we live in an arid state with frequent droughts, is climate change a novel problem for your organization?

    b. How does climate change make existing problems such as [list problems they mentioned previously one by one] worse?

    c. How would climate change create challenges for delivering agricultural water to farmers?

    d. How would climate change interact with the rapidly increasing population in Utah?

    e. How would climate change interact with urbanization of former agricultural land?

    f. How would climate change interact with the current trend of transferring water from agricultural uses to municipal and other high value uses?

SECTION 4: CURRENT USE OF INFORMATION AND MODELS

I have just a few more questions about the information and models your organization is using to make water management decisions.

1. What information is your organization using to predict water supply, both year-to-year and at the decadal scale?

2257 2. What information is your organization using to predict water demand, both year-to-year and
2258 at the decadal scale?

2259 3. How is your organization coupling water supply and demand models?

2260 4. How is your organization modeling dynamic changes in hydrologic, ecological, and social
2261 systems when predicting water supply and demand?

2262 a. How is your organization taking into consideration these dynamic changes in future
2263 water management and planning?

2264 b. If your organization is not doing it currently, what is preventing your organization
2265 from considering these dynamic changes?

APPENDIX D - PARTICIPANT DEMOGRAPHICS CATEGORIES

1. What is your gender?
   a. Male
   b. Female

2. What is your age?
   a. 18-29 years old
   b. 30-49 years old
   c. 50-64 years old
   d. 65 years and over

3. What is the highest level of education you have completed?
   a. some high school
   b. high school graduate
   c. some college
   d. trade/technical/vocational training
   e. college graduate
   f. some postgraduate work
   g. post graduate degree

4. What is your religious preference?
   a. Roman Catholic
   b. Seventh-Day Adventist
   c. Mormon
   d. Christian Scientist
   e. Muslim
   f. Protestant
   g. Jewish
   h. an Orthodox church such as the Greek or Russian Orthodox Church
   i. Something else (please specify)

5. Would you describe yourself as a "Born-again" or evangelical Christian?

   a. Yes

   b. No

   c. Don't Know

6. Do you happen to be a member of a church, synagogue, mosque, or other organized religious group?

   a. No

   b. Yes

7. Did you happen to attend church, synagogue, mosque, or some other religious worship service in the last seven days?

   a. Yes, Did attend

   b. No, Did not attend

8. Ethnicity: We want to be sure that we have spoken to a broad mix of people in your area. Are you, yourself, of Hispanic origin or descent, such as Mexican, Puerto Rican, Cuban, or other Spanish background?

   a. Yes

   b. No

9. Race: What is your race? Are you White, African-American, or some other race?

   a. White

   b. African-American

   c. Other (please specify)

10. Other than the effort required for the agricultural operation, are you now employed full-time, part-time, not employed, or retired?

   a. full time

   b. part time

   c. not employed

   d. retired

11. Including yourself, how many people live within your household?

12. Are there any children under the age of eighteen years currently living in your household?

    a. Yes
    b. No

13. What is your marital status?

    a. single/never been married
    b. married
    c. separated
    d. divorced
    e. widowed

14. How would you describe your political views?

    a. very conservative
    b. conservative
    c. moderate
    d. liberal
    e. very liberal

APPENDIX E - HISTORICAL CONTEXT

Hunter-Gatherer, Farmer-Rancher Transition

At least since the beginning of the current inter-glacial period, human need for a regular supply of specific nutrients can be seen in various forms. The analysis of hair samples from ancient human populations compared to those of present day indicate little change in the chemical makeup (Macko, et al, 1999). Bone fragments tell a similar story (Richards, 2002).

This data stands in stark contrast to the ancient ancestors of humanity. Evidence for that period mainly is in the form of the stone tools used for food preparation (ca 300,000 – 500,000 years old). These artifacts indicate a focus on animal proteins (Richards, 2002). Prior to this age the dietary regimen was primarily plant based (Konner & Eaton, 2010), Thus, this period would indicate transition from pure gathering/foraging to hunting; that is, from herbivore to carnivore/omnivore.

The Paleolithic age, ranging from 2.6 million years ago, to 10,000 years ago, mark the drastic change in hominid existence (Richards, 2002). The hardy souls that emerged from the last major glacial period discovered that the hard, indigestible objects in the foraged crops, would miraculously sprout into plants, producing the same fruit or vegetable; thus, they became farmers and ranchers (Cleveland 2014). What drove each tribal unit at the various geographically dispersed population of what would one day be Europe, to adopt, first, a simple, primitive form of agriculture, and then to add various species to the menu, is still debated (Price, 2007). For the California Paleo-Indian groups, the conversion is thought to have followed the extinction of large animals). This was likely a result of a combination of both climate change as well as excessive hunting by humans (Fagan, 2003).

As late as the fourteenth century CE, the Californian central coast inhabitants were still exhibiting the practices of hunter-gatherers, mainly with respect to the use of seafood (Moratto, 1984). This appears to have been a practice continued from the mid Neolithic age, where the Channel Islands were a base of operation with easy access. At the time the sea level was such that the coastline extended out approximately an additional 20 miles, making the islands a mere 6 miles away (Fagan, 2003). As the sea level rose and stabilized, the distance from island to shore resulted in permanent settlements. Middens found on the islands indicate either long term habitability or a short-term camp for specialized processing of various sea life intended for sustenance (Moratto, 1984).

In either case, the littoral seafaring method provided a significant portion provisions of seafood of those who would become the Chumash tribe. This process would be employed form the middle of the Neolithic age (Moratto, 1984) to the centuries immediately prior to the European invasion (Moratto, 1984).

Late in the Neolithic age, climate change impacted the fauna such that dependence on foraged plants became the norm; one of the main staples was the acorn (Fagan, 2003). The fifteen species of oak, that flourish in California could be expected to provide a generous yield each autumn. Though the humble acorn was not a panacea, it was at least an abundant and easily stored commodity (Fagan, 2003).

The full picture of the transition from basic hunter-gathers to rancher-farmers, along with much of the past of California, is clouded by archeological data mangled by the so-called “progress of man” (Fagan, 2003) and a historical record that tends to paint the European invaders as saviors for the indigenous tribes; in the location of concern, that would 10).

By the time of the European invasion the Chumash had a well-developed process for tending the native flora of the California Central Coast. The recurring weather variations, having been noted over the years, were used as a timetable for various tasks to maximize utilization of the respective resource (Anderson, 2005). What, in the mind of the ill-informed European appeared to be foraging, was a well-defined and calculated process, scheduled to coincide with specific weather changes (Anderson, 2005). That the produce was foreign to the conquistadores perhaps led them to believe these "Indians" were ignorant savages?

The difficulties endured by our ancestors entailed issues that present day citizens of developed nations could hardly comprehend. When a natural disaster occurs, such as a hurricane, wildfire, flood or earthquake, we, the privileged of the first world, feel a very slight level of that stress.

My wife was born and raised in the Cordillera Mountains on the island of Luzon, in the Philippines. Her family were (and are) subsistence farmers. While she was growing up the closest electricity was a several kilometers walk through the woods on a footpath, since there were no roads. Ignoring the recommendations of her family to quit wasting time with school, she moved to a location where she was able to finish secondary education and then to the provincial capital to complete a bachelor's in elementary education.

The description she gives of the arduous days, sleeping in a small hut (parents, three brothers and four sisters) and cooking and heating water over an open pit fire, while trying to grow sufficient food for the family using only rudimentary hand tools is very much like that described by Fagan (2003) and Moratto (1984) for the early inhabitants of the California Central Coast as they strove to survive natures obstacles.

The Western Pacific Ocean, famous for unleashing a dozen or more typhoons on the Philippines, would regularly destroy crops, and their simple, primitive homes. The droughts, wildfires and subsequent floods seen on the other side of the Pacific, would pummel the central coast of California, impacting the various tribal units with equal devastation (Fagan, 2003).

With any circumstance of want there would invariably be the prospect of those who have not, envying and in some cases, attacking those who had stocks of food sources. Details in the archeological record are only vague for these conflicts just showing evidence that the strife had ended (Fagan, 2003).

Knowledge of the prospect of drought and/or famine, led to development of storage systems (Anderson, 2005). Granaries were erected to store seeds of various sizes and provided a certain level of water resistance. Keeping grains dry was particularly important, since even a little moisture could allow bacteria or fungi to grow and spread, leaving the contents inedible (Anderson, 2005). In addition, certain plants were used to line the structure, acting as an insect repellant. The outer walls were tightly assembled to minimize the possibility of entry by vermin.

Coincident with the difficult times were the rise of chieftains; “Big Men”, as Fagan calls them, or aggrandizers. These exercised leadership skills to coordinate with the various “triblets” (a term coined by Alfred Kroeber, Fagan, 2003), to form alliances to share resources. While this effort can be seen to have minimized violence, the “Big Men” would also take advantage of the power to improve their lot above that of the rest of the people; hence, the moniker, aggrandizer (Fagan, 2003). The definition of classes within the society

invariably produced nepotistic elevation of leaders. Such that, wealth, as well as the influence that goes with it, would pass within a family or a circle of friends (Fagan, 2003).

The implementation of what is essentially a natural system model, would present an additional impediment to the production and distribution of food (Scott & Davis, 2006). That being the potential that a succeeding generation in a dynasty might be, and occasionally was, incompetent to the task of leading (Fagan, 2003). And as with any form of social caste system there will always be those who are treated better than other. Thus, social injustice became a stowaway on the ship of state that was the Chumash tribal system (Fagan, 2003).

In the end human ingenuity is thought to be driven by the varying climate and increasing population to invent the various processes and implements used in providing food (Glassow, et al, 2010).

APPENDIX F - SYSTEMS PERSPECTIVE

The intent of this study is to analyze intersecting systems which impact the supply and demand of water. The geographical focus will be on the San Joaquin Valley of California. The systems germane to this effort include but are not limited to: geological, hydrological, meteorological, anthropological and political. Each system has been assessed to determine the eventual, net-effect on the supply of water. The intent was not to provide an exhaustive discussion of each discipline but to show how it affects the outcomes of water requirements and availability. The resultant policies implemented to control these various aspects of water were identified and determined to either adequately or inadequately provide solutions to issues formed from the negative impacts of the various systems.

This paper will begin to fill a void of scholarly data attempting to identify common and discreet issues within the body of water related policies. Conclusions should be considered by the various government agencies engaging in the processes of defining water-related management policies and contingency plans.

Introduction

The recent water crisis in the state of California and in the Southwest of the United States is a symptom of an issue which is proving to have a much broader impact. As the human population has increased over the millennia, the growing scarcity of water has caused water shortage to become an urgent problem throughout the world (Kummu, et al, 2010). The recent drought in the Southwest of the USA brings home this reality that water shortage is no longer confined to the developing nations of the world. Studies by climate scientists indicate that, with the climate change now leaning heavily toward global warming, this

drought may last for decades and even grow to a global disaster. Human ingenuity must be harnessed to devise and enable sustainable yet agile solutions.

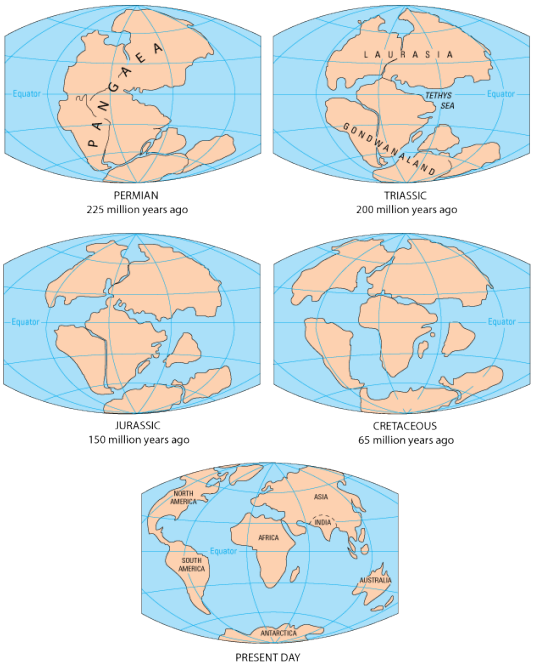
The vision of this research has been to observe the past and present of five major systems which impact water in general but specifically the supply, distribution and demand. These separate systems act apart and interact as a whole whether in concert of as a cacophonous din.

When two factors present as conflicting priorities and requirements completing for attention there is a circumstance which confronts with a pair of undesirable actions; the proverbial no-win situation, also known as a double bind. In any paradigm as complex as water on a planet is, there is much more than a double bind; there is a multi-bind. Though there are other factors that have to do with water, with this paper the intent is only to look at five major factors. As the past and present context is considered the potential future is presumed.

The History

A. Geological

If one were to use a single word to describe the history of the San Joaquin Valley it would be best to call it tumultuous. Up until the Late Cretaceous–early Cenozoic period there was no such valley or the mountain ranges which now surround it (Henry, 2009). The valley originally formed as a Forearc basin as a result of tectonic interaction of the Pacific and North American plates. At the time the major fault consisted of the Pacific plate in subduction under the North American plate. This resulted in a wrinkling or buckling effect creating the various mountain ranges running north to south; those of this focus are the Sierra Nevada and the Coastal Range. The main interceding valley between these ranges being the San Joaquin. All this occurred well into the disassociation of Pangea, the super continent. Historical certainty would be virtually impossible for the preceding 4 billion plus years that followed the genesis of our planet.



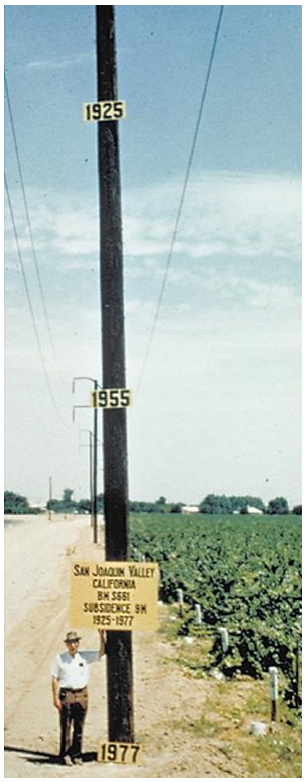
F1 - Pangea, Gondwanaland, Laurasia and Tethys

[Online image]. (2007-2008) Retrieved April 27, 2016 from http://earthguide.ucsd.edu/eoc/teachers/t_tectonics/p_pangaea2.html

The continuing movement of tectonic plates has affected the configuration of the state of California as it certainly has the whole of the earth. But the California Coastal range has seen the bulk of the local adjustments as a result of the various faults. The all too well-known San Andreas has impacted the western border of the San Joaquin Valley as a result of its many temblors. Of minimal affect has been the Harlock Fault which intersects with the San Andreas in the Antelope Valley at the western most region of the Mojave Desert. This fault forms the Tehachapi Mountains, which border the southern extreme of the San Joaquin Valley.

Most of the major geological development of the San Joaquin predates the arrival of human inhabitants. The geological configuration was, at that time, essentially what it is today. The major changes have been the relative height of the land; at some locations this value has increased by as much as 4 meters in the last 1000 years. Much of this of late has been determined to be a result of subsidence due to ground water over use.

The graphic shows what was determined to be the location of the maximum subsidence in the United States identified by Joseph Poland of the United States Geological Survey. The subsidence from 1925 to 1977 alone was measured at 28 feet (Galloway, Jones & Ingebritsen 2000, p. 23).



F2 - Subsidence in the San Joaquin (Galloway, Jones & Ingebritsen 2000, p. 23)

Humanity has built bridges over chasms, tunnels under the sea and hung communication devices above the sky, but in no way have we scratched the surface of what the forces of nature might unleash in the geological realm.

The indication from the historical geological evidence is that there are potential issues that could occur which either would provide a near panacea for water issues if subterranean reservoirs were then to be exposed or the pariah if the geological structure were to then impede the resourcing and delivery of water to the various points of use.

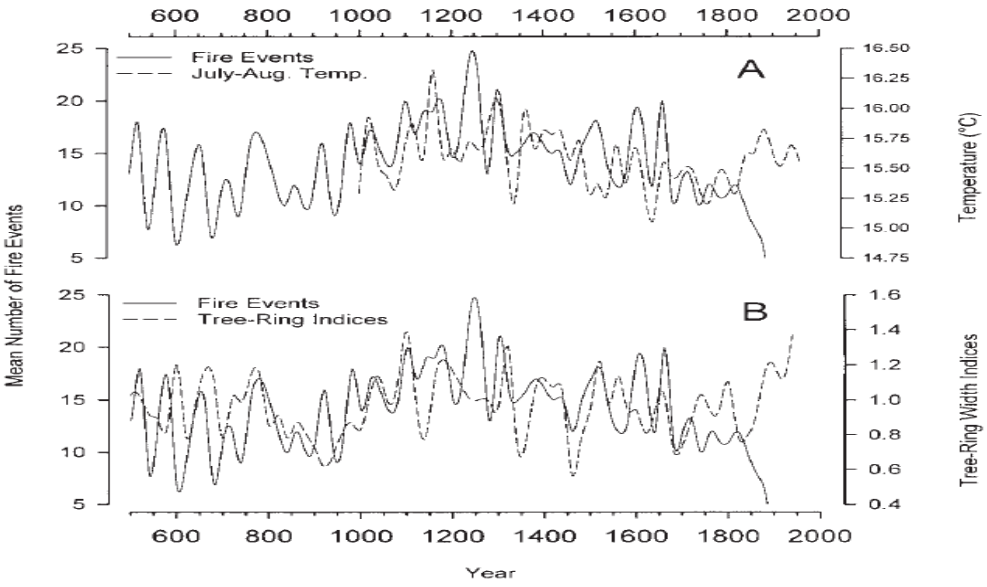
B. Meteorological

Climate has ever been a major factor in the struggles of humanity. It is estimated that we have lived through as many as nine glacial episodes in the preceding seven hundred millennia (Fagan, according to Ingram & Malamud-Roam, 2013). Between these glacial ages were periods simply known as interglacial (Ingram & Malamud-Roam, 2013, p.68).

The climate of the San Joaquin Valley has generally followed the global system of a dynamic paradigm; particularly that of North America and northern Europe. When the North American continent was covered with a sheet of ice so was what would become the San Joaquin Valley. As the North American climate warmed and the ice sheet melted much of what is now the United States of America became a lush tropical environment.

The latest thawing of a glacial period was about twenty thousand years ago. At the peak of that glacial cycle (known as the Glacial Maximum) a sheet of ice as much as two miles thick covered North America and northern Europe.

Analyses of various factors indicate that, since the end of the latest ice age, a trend of fluctuation between periods of significant precipitation and prolonged droughts. Tree ring analyses provided evidence of yearly states of climate and the trends show variations with wide differences in periodicity; over the period from the late sixteenth to mid twentieth century BCE, droughts ranged from ten to sixty years (Veblen, et al, 2003). It can be seen in the rings where lower growth or the scars from a fire specifies an episode of drought.



F3 - Tree Ring Data Graph (Veblen, et al, 2003)

As with the geological system that of the meteorological is difficult to assess with respect to the future. The exact cause(s) of the glacial periods and inter glacial periods cannot be absolutely identified. The basic principles at work which are component to these cyclic phenomena can be specified and measured; with these at present and the records of past changes templates have been developed with model the climate fluctuations. Thus, an estimation of future climatic events can be approximated. However, application of these

models has not always been accurate enough to establish affirmative action for consequent issues; whether to deal with a prolonged drought or to collect and store excess run off in phases of greater moisture (Spada, et al, 2013).

C. Hydrological

As the San Joaquin Valley began to form the surrounding mountain ranges emptied their run-off therein eventually creating a lake. As with many such land formations the historical paradigm of a body of water developing, whether as a result of melting glaciers and simple mountain runoff, eventually leads to a marsh, meadow then forest. This process is as a result of the aging terrain and continued decrease in water shed as the ice sheet and glacial impact recedes.

At about the time that Europeans began to explore what is now the western United States, the San Joaquin Valley was essentially a series of lakes, swamps and bogs dissected by numerous rivers (Hundley, 1992, p.5).

The run-off from the Sierra Nevada and coastal ranges maintained the valley in a state very much a lake. During periods of drought the level subsided; in particularly long drought phases the valley would reach a condition which is essentially the same as is seen today, where the ground level experienced subsidence to an extreme degree.

The intersecting outcomes of the geological and meteorological systems provide the factors which generate the hydrological product. The basic character of these systems included an unreliable nature. Thus the course or flow of a river cannot be assumed to be available ad infinitum. Nor can it be expected that lakes or aquifers will ever be full.

D. Anthropological

The first human inhabitants of the San Joaquin Valley are believed to have arrived around 11,200 BCE. It is assumed that these pioneers came from the south since at the time the glaciers and snow of the Cascade and Sierra Nevada mount ranges would have made it impossible to come into the valley from the north (Fagan, 2004, p.3). These early inhabitants may have been members of the seafaring adventurers who first landed on the transverse coast of California; what is now Santa Barbara County. These were most likely of the Coastal Miwok tribe (Fagan, 2004, p.134). Up until the arrival of the Europeans the inhabitants of the San Joaquin Valley engaged mainly in hunting, fishing and foraging for fruits, nuts and other fodder that could be found growing in the wild. Eventually the concept of agriculture was discovered and implemented on a small scale at various small sub-tribal locations.

The various tribal units initially had little cause for hostility toward one another due to the ample supply of natural resource. As the environment began to grow more arid and the resulting decrease in resources, inter-tribal hostilities arose (Fagan, 2004, p.32). As the European invaders began to dominate the land, as well as the indigenous peoples, the strain on the natural resources began to engender strife; erupting into hostile disputes both between the various tribes and the European occupiers.

In the end the Europeans either forced the native population to migration to less desirable climes or into slavery (Johnston-Dodds, 2009, p.17). The eventual over utilization of the San Joaquin Valley in the most recent five hundred years has contributed to the extreme impact of the current drought.

E. Political

Since the conquest by Europeans of the Americas the administration of natural resources has become an issue. With the influx of Europeans intent upon building new lives in what was assumed to be a frontier, the land and it many natural resources, were taxed at a level never before seen by the indigenous population. Consequently, efforts by the invaders were taken to control the natural bounty for themselves while limiting access to the local tribes.

The forced conversion by the indigenous tribes by the Spanish conquistadores associated priests subjected them to the rule of the Church. The royal land grants to wealthy or well-connected Spanish immigrants gave the grant holder carte blanche in the use of natural resources on their property without regard for the needs of the tribes. Essentially the tribes were conquered and then subjected to all but slave labor. As grand and storied as the California missions are it cannot be forgotten that they were built by the blood, sweat and tears of a subjugated people (Haas, 1995).

Today the efforts to control water usage have seen limited success. After five years of drought a declared state of emergency has required the reduction of residential and business water use by at least 25%. Failure to meet the standard incurs fines. In response the average decreased use has been over 40%. Though this reduction is commendable it is questionable whether it will have any real effect on issues of water. Other than mandated usage reductions the political efforts have been focused on apportioning what little water is available (Thompson, 1993)

II. The Systems

A. Geological

The geological system of planet earth consists of a stock and flow of matter and its mass which is evident in the discharge and exchange of energy seen in seismic movement and volcanic action. This system, though its impact on humanity, and the other inhabitants of the planet, is generally slow and subtle, it is nonetheless significant and on occasion catastrophic (Meadows & Wright, 2008).

Over the many millennia tectonic displacement has had the most affect on the planet in general and humanity in particular. The evolving attitude of tectonic plates has defined a dynamic trajectory of the many systems of watershed. Both surface and subsurface bodies of water are impacted by adjustments in the tectonic paradigm.

The geological system has been evolving for the last four billion years and can be expected to continue this process. The action of the evolving geological system has, and will continue, to define the boundaries of courses of watershed and bodies of water. Seismic activity can impact the flow of subsurface water sources. Pressure exerted on an aquifer might increase the volumetric flow rate for discreet springs and eventually causing water courses to change proportionally (Johnson, 2016).

In aggregate, the geological system, though its consequent functions are significant, would appear to have settled into a relative state of stationarity. Without cataclysmic geological system adjustments on a biblically epic level, the probability of momentous net results is not likely.

B. Meteorological

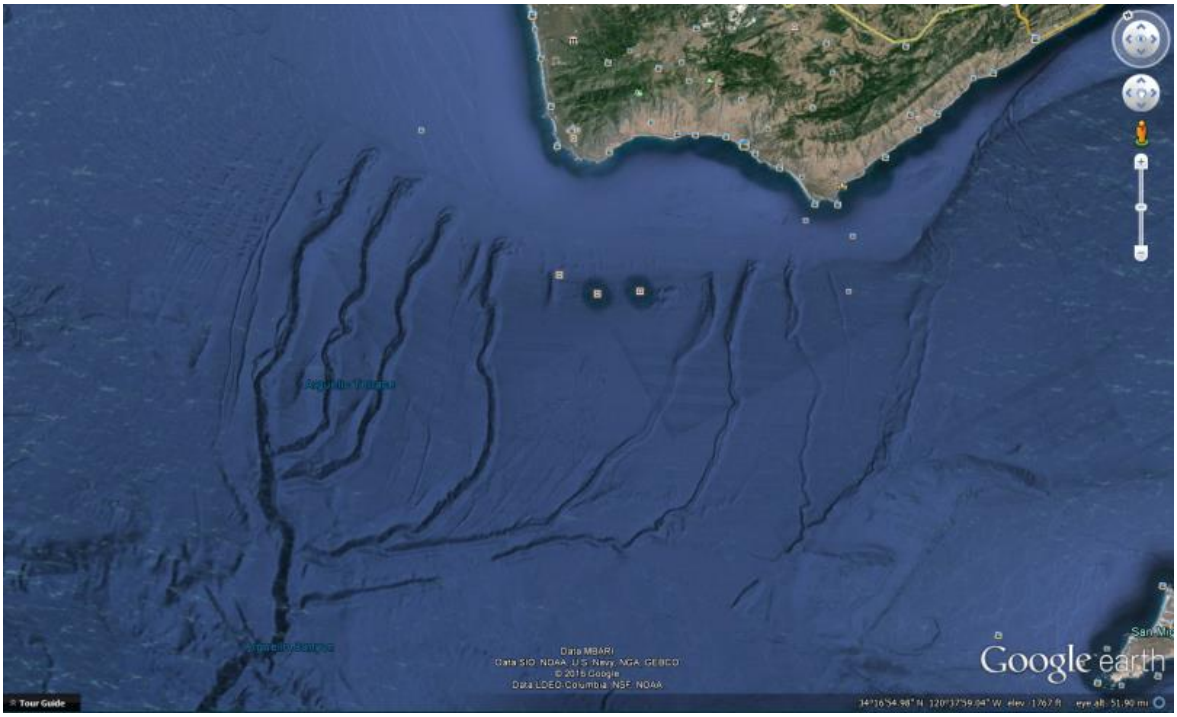
The Meteorological system of planet earth consists of a stock and flow of gasses, liquids and suspended particulate which resides in the atmosphere. Unlike that of the geological system this system's impact on humanity, and the other inhabitants of the planet, is generally sudden and fickle, it is absolutely significant and on occasion catastrophic. This fickle nature makes the purveyors of meteorological prognostication the common butt of jokes about the weather. Yet this is the nature of climate in general and weather in particular. What the weather might have been in the past may assist in the estimation of what it could be in the future, but it cannot be perfectly accurate. Still, there are marked variations in the patterns of the meteorological systems. The most drastic, yet long and drawn out, process of change can be seen in the transition from a glacial epoch to an inter-glacial period (Kleman et al, 2013, p. 2375)

The character of climate/meteorological system has been very much a victim of the intersecting systems. Even during a time about fifty-three million years ago (the Early Eocene Climatic Optimum) was not invulnerable to the effects of greenhouse gasses (Allegre, et al, 2005, p. 9). At that time the levels of carbon dioxide increased significantly as a result of methane released from vents in the ocean floor. Consequently, average global temperatures increased to as much as 4.6 degrees above that of the present day.

C. Hydrological

The hydrological system of the planet consists of the stock and flow of water in any of the three phases, liquid, solid and gas. There is also a possibility for a fourth phase of water known as plasma. However, the presence of water in this state is rare (Abascal & Vega 2005).

The behavior of the hydrological system, as with that of geological and meteorological systems, is in a constant state of change. That is, it is never actually stable. Lakes may suddenly or slowly drain, rivers overrun their banks or run dry and subterranean aquifers dissipate. An astounding case in point is a resent discovery which came to light; that during many humid episodes in the late Quaternary there was a large river system running through the Western Sahara (Skonieczny, et al, 2015). Conversely, evidence shows that there were once rivers running where the oceans now meet the various continents; in particular the sediments and underwater geological terrain on the continental shelf of the pacific coast of California, there are clearly water courses and even waterfalls.



F4 - Water Courses - Point Conception, California (Google Earth)

As each glacial period builds up the glaciers and ice sheets it is siphoning the water from every source via evaporation. The oceans obviously being the main source would sink to some four hundred feet below the current “sea level”. As the planet entered interglacial

periods the ice sheets and glaciers melt and cause lakes to fill low lying areas and rivers where a difference in potential energy is present due to decreasing land elevation.

D. Anthropological

Humanity has ever congregated, if for no other reason than, at least for mutual survival. These groupings at the foundation were simple organizational systems in the vein of the natural system model.

The basic unit of division was and tends to still be what has come to be known as the nuclear family. The grouping might take on many different forms throughout the ages and in different locations as they form and reform to meet the needs of each discreet set of challenges. As any unit grows the need to acquire resources consequently increases. In addition, individuals would develop new skills and tools to deal with the evolving needs within a particular unit.

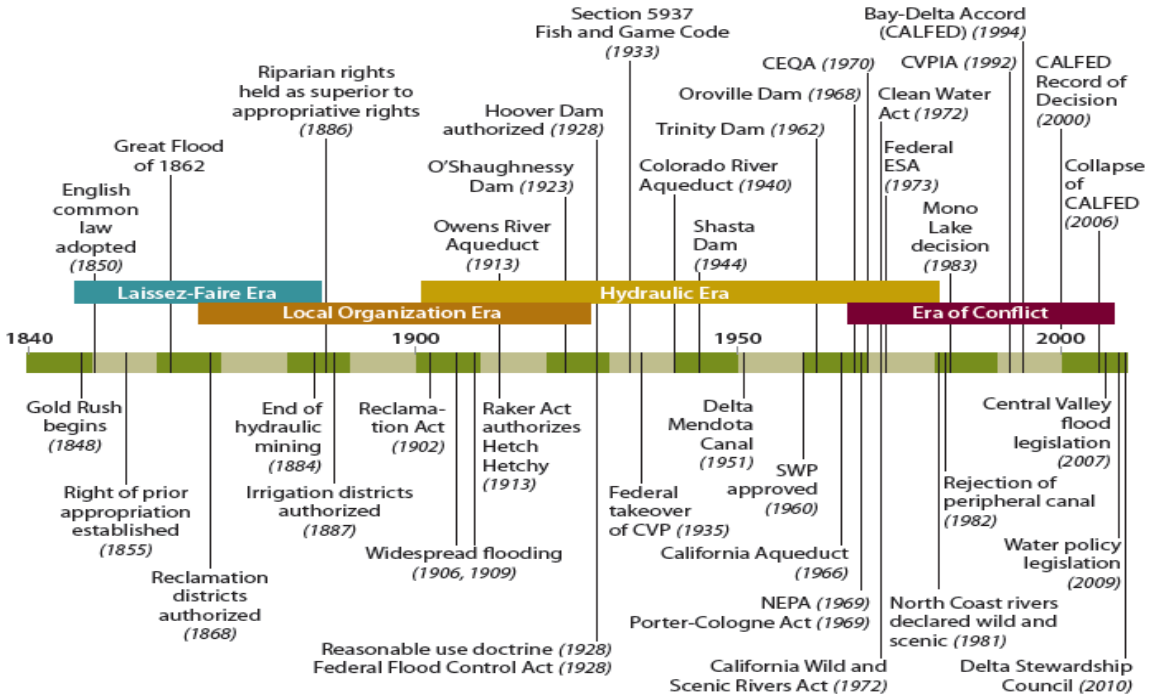
The utilization of natural resources would have become an issue as the unit of social division began to strain the supply. The most rudimentary purposes for water use being ingestion and cleaning.

As a system anthropological stock might be considered anything from raw population count to some measure of production. For the purpose of this study humanity would be a negative factor of flow in the equation of water issues. A higher population count would produce a greater demand on the water source(s) and thus a decreased over all water stock (Fagan, 2004, p.144).

E. Political

As the human social units grow it becomes apparent that there must be defined standards of behavior. Such standards would eventually be developed in application to natural resources. This would at least come about when it became evident that availability of those resources was beginning to decrease.

As the population of California increased and the dependency of much of the nation upon the bounty of the San Joaquin valley, the formerly plentiful supply of water from the various immediate sources has been depleted while the root sources have not kept up with the increased flow. Political elements in the San Joaquin valley, as well as those of the state of California at large, have attempted to reconcile this continuing deficit mainly by limiting water use for various purposes; specifically, personal/residential and industrial/agricultural.



F5 - Chronology of California Water Laws (Hanak, et al 2011)

The earliest policies were directed at the indigenous tribal units. These prevented the tribes from living as they had for many generations. As with many other policies enacted at the federal level, these policies had the net effect of disenfranchising the tribes of their ancestral homelands; water being one of its many. The injustice brought upon the tribes essentially stole the land and its resources from them and gave it to the conquering European invaders (Johnston-Dodds, 2009).

Later policies began to address the occasional water supply issues brought on by droughts and over-use (Thompson, 1993, p. 674). Up to and including the 1960s saw a policy which was seen as a political-engineering approach; where ever there was a need for additional water supply the Federal government would build another water project (dam/reservoir, aquaduct, etc). These methods unfortunately lead to a significant level of environmental damage in addition to being economically costly. Since the 1970s, however the paradigm employed has been market based. This has been operated as if it were not but another capitalist venture. It was assumed that as demands grew that "the market" would grow and provide the need.

III. **The Potential** (future?)

A. Geological

The roots of the present are buried deep in the past (Stubbs as cited by Hutton, 1906). These realities portent a potential for a cataclysmic intersection of systems in nature upon which humanity has little if any impact, much less has control over. Even a slight shift in the tectonic pattern can alter meteorological and hydrological systems (Johnson, 2014). The process of hydraulic fracturing in the petroleum industry might be a consideration for

application to extracting ground water. However, the concern would be for the sustainability as well as the potential for damage to the environment.

B. Meteorological

In locations where hurricanes are an annual worry, many families will have a small gasoline powered generator they keep for those occasions when the latest cyclonic episode leaves their home in a state not unlike that of one in nineteenth century South Eastern United States. Anticipatory preparation at any organizational level can provide a welcome respite from the impact of known hazards, whether an evacuation plan that reverses the flow of traffic on an interstate freeway to double the speed of egress.

Since the temper of the climate cannot be absolutely anticipated much less tamed it is unlikely that any reactionary effort will suffice to harness significant precipitation and store it for future use. Generally, such efforts consist of damming rivers at points to create a lake or reservoir. This method has been in use for most of the last three millennia. Even those longest in operation can be seen to have had destructive results if nothing more than the elimination of habitat leaving innumerable species to move, adapt or go extinct.

C. Hydrological

Diverting the natural flow of water via human made ditches, gutters and aqueducts has been a method for controlling the flow and collection of water at least since the second millennia BCE. Simple analysis of water sources and demand should dictate the design of systems to collect and deliver water in such a manner as to minimize environmental impact. In addition, it is only logical that the source be deemed sustainable or that the effort and resources expended to affect the water delivery be reasonably considered so as to ensure that

a legacy operation not have wasted time and resources only to have the root source be exhausted.

The lessons learned from previous efforts must be a major factor in the equation which is employed to determine any course of action or expenditure of funds. The numerous dams now being dismantled are classic examples of discouraging failures. A favorite case in point is the Matilija dam near the Ojai Valley of California. Intended to provide water to the residents of the valley as well as minimize the impact of flooding into the Ventura river water shed, the lake that formed at the completion of the dame quickly silted to the point where there was barely four feet of water on top of the lake of mud. Not only has it never provided a drop of water to the intended customers, it has also caused a minor ecological disaster in that the silts that at one time ran down the Ventura river, providing stability to the beaches at the river's mouth, are now trapped behind the dam. Thus, the beaches, which were once the pride of Ventura (and a favorite of surfers) does not exist. It is now mostly gone, eroded away by the Pacific waves.

D. Anthropological

The people of the San Joaquin Valley are mainly involved with the industry of agriculture. These approximately 4 million people stand apart from most of the rest of the state in that the industries and occupations of the rest are more diverse. Thus, a dependency upon water for one's livelihood is not a primary consideration for the other 36 million people.

Unfortunately, there has been a sense of "us and them" with the allocation of water resources, such that those in urban and suburban areas feel enmity toward the agriculture industry. When Governor Brown recently called for a reduction in water usage there were

groups of residential customers who complained that the cuts did not impact the industrial use. The truth is that the order for reduced use did impact agriculture to the extent that many acres of crop lands, which were once fruitful, now lie fallow and in many cases farmers have had to destroy withering trees of various types.

E. Political

The recent drought, lasting nearly seven years had driven the state to enlist local authorities to reach out to each other and plan to work in concert to preserve what little water resources that are available (SJVWIA, 2015). Still the thrust of policy effort is directed at usage; that is, the flow out of the overall water system is addressed but virtually no effort is made to identify and implement alternative water sources.

Conclusions and recommendations

The factors impacting sources of water and those which impact usages can be seen as various sub-systems of a singular system. And as each sub-system is altered, its impact on water supply and demand changes, whether to increase or decrease. Although there are certainly other factors which impact water availability and/or quality, these five (geological, meteorological, hydrological, anthropological and political) would seem to have the greatest impact. Others such as industrial and agricultural effluent, which impact availability and quality, are understood but have not been addressed specifically here due to their being a component of the anthropological system.

The evidence extant from the geological record is replete with details of our planet's history. This historical account proves beyond doubt that the planet has undergone significant change in the last four and a half billion years since it was slung off its star, our

sun (Allegre, et al, 2005). Most of that time was spend in a geological state like what it is now. The earth's crust had formed and was broken into the various tectonic plates; water was evident in subsurface aquifers and surface bodies ranging in size from small ponds to oceanic expanses covering much of the tectonic plates after about one hundred million years.

The meteorological condition of the planet has varied as it has (and is varying) in the current epoch but with the one significant difference being in the duration of the extremes. The coldest periods entailed episodes where precipitation was of biblical proportions and to the extent that as the temperatures plunged below the freezing point the planet was in a perpetual winter with sheets of ice developing, mostly at the North and South poles. The thickness of these sheets rival that of our current southern pole. During this period, in the northern hemisphere, an ice sheet extended over much of North America and Europe. These ages, commonly known interchangeably as "ice ages" or "glacial epochs" were punctuated by relatively short periods of warming trends known as "inter-glacial periods"; our current age is the latest of these following a glacial epoch which came to an end approximately twenty thousand years ago.

The hydrological condition of the area in question, had quickly reached a state of severe drought as a result of the aforementioned factors combined with the excessive water use by humanity. In only the last five hundred years there have been numerous periods of drought ranging in duration from 10 to 60 years (Veblen, et al, 2003). The only difference between those situations and that of the most recent is that the population, and therefore demands on the natural hydrological systems, is many times greater. The estimated population of the Americas north of the Rio Grande, in pre-Columbian time (<C.E. 1492),

range from 900 thousand to 1.15 million. If one estimates a population of what is now California as approximately 12% of the total (based on California Population of 39,144,818 from 2015 census and a US population of 321,368,864 July 2015 estimate from CIA World Fact Book) the population of California would have been between approximately 110 and 140 thousand. This number would have placed a much lighter load on the water sources than the nearly 40 million of today. Thus, the impact would have been minimal at worst (Lord, 1997, p. 69).

As previously mentioned, the values from the various sources indicated that the population of California, and therefore that of the San Joaquin Valley, has drastically altered the outcomes of the combined intersection of these separate systems which impact water supply and demand (Lord, 1997, p. 69). Thus, the anthropological system has over the ages impacted the water context with a net negative value. Yet it is not mainly the population in the valley which are overtaxing the water supply, it is also the agricultural industry (DWR, 2008).

An intersection of the geological and meteorological systems of the planet can be seen in the formation of ruptures in the tectonic plates as well as the seams between them (Johnson, 2014). This volcanism causes changes in the climate locally and as in the case of the most powerful eruptions, global years long winters. These mini-glacial periods can have the effect of producing significant amounts of runoff from the additional snow fall and glaciations which replenishes the depleting aquifers. The expectation of these occurring at any time soon or in measure to offset the current drought condition, though possible, are so improbable as to be considered little more than childish and wistful dreams.

Since the planet has been operating in this manner for most of its existence it is probable that it will generally continue to behave this way. Thus, the fact that the glacial ice sheets of North America would melt during a period like the current, flooding the planes, and valley, carving river courses and canyons as the water finds its way to the sea or a landlocked body of water, then that is what most likely will happen in the future. The thinking that our observations from the records of the last few millennium can be trusted to predict the future is to assume that this brief moment in the history of the universe (Hawking, 1988), of perhaps ten thousand years, will remain in a state of stationarity; that the cycles will always continue in the patterns which have been measured by humanity. Sadly, the larger view of our history tells us that stationarity is transitory, or has never actually existed (Milly, et al, 2008).

Since there is little chance that humanity will be able to affect any changes on the major systems of the geological, meteorological or hydrological to produce more fresh water, it is incumbent upon leadership, in addition to the reduced usage, to move toward alternative sources and methods of providing fresh water for the planet. In this way the other two systems in question, anthropological and political, might devise a way forward that could provide for the needs of humanity as well as the rest of the planets flora and fauna.