# USE IT AND LOSE IT: AN ETHNOGRAPHIC APPROACH TO GROUNDWATER USE IN THE SAN LUIS VALEY

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By

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# Abstract

This paper investigates groundwater depletion in the San Luis Valley as a lens to analyze the larger crisis of groundwater depletion in the U.S. Using a series of interviews this paper highlights the realities faced by farmers experiencing groundwater depletion threatening their occupation. Relying on water law in the west and theories of governing common resources I track how western agriculture came to be in such a crisis

# Introduction

While doing my research for this project, I often thought about my first time coming to the San Luis Valley and the wide variety of attractions that captivated my interest. It's not difficult to fall in love with landscape. The vast high alpine desert lies 8,000 ft above sea level and is complimented on both sides by jagged snow capped peaks. Nestled into the base of the Sangre de Cristo mountain range lies soaring sand dunes that look as if they were plucked right out of the Sahara. If you're lucky enough to be passing through on a clear evening, you'll see the jagged fourteeners glow a soft red which is aptly how they received their name-- the blood of Christ mountains. Not far away from the dunes is a town that has the most spiritual retreat centers per capita in the U.S. and several hippie communes. If you head south towards Alamosa, which has a population of 9,900 you'll pass an alligator farm and a UFO watchtower. The valley has a knack for attracting an eclectic group of people which can often steal the show from what is arguably its most interesting aspect, agriculture.


*Figure 1. Highlights the 5 counties which make up the San Luis Valley*

The valley is an agricultural mecca being the second largest producer of potatoes in the United States as well as a large producer of alfalfa, sorghum, lettuce and cattle. What sets apart the San Luis Valley from any other rural agricultural center is that it's the only true desert in Colorado, receiving an average of 8 inches of rain per year (Huber, Larkin, 1996). The possibility of fruitful production in a valley that's full of cholla cactus and desert brush seemed so impossible my first visit, I hardly even noticed the large bales of alfalfa and the wiry outline of circle irrigation sprinklers interrupting the wide-open landscape. The only reason the valley can support an agricultural economy is the vast sea of fresh water contained in two aquifers which lie beneath its mud cracked floor. The confined aquifer lies deep below the valley floor and is sealed off by impermeable layers of clay and the unconfined aquifer lies just beneath the

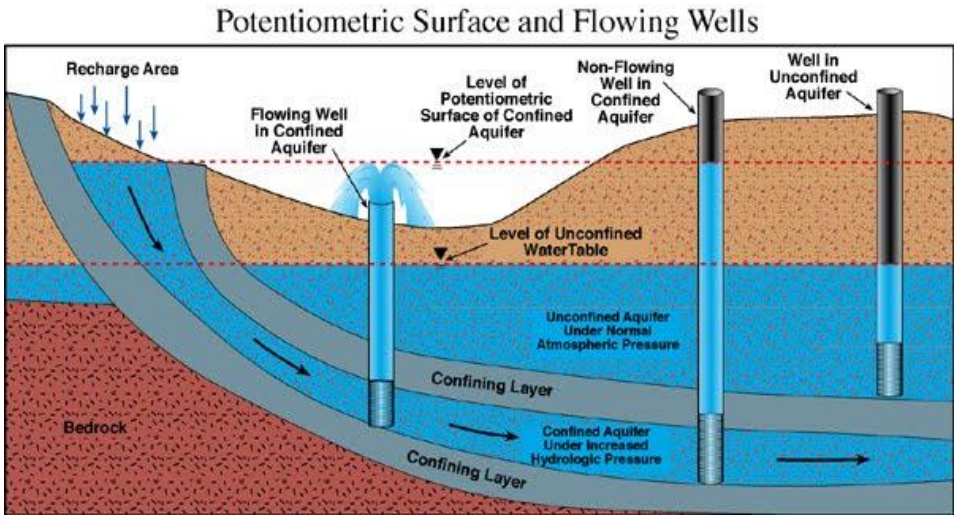


*Figure 2 portrays the geological layout of a confined and unconfined aquifer.*

surface and is responsible for creating several wetlands across the valley. For decades, these two aquifers have made fruitful life possible for those who chose to call the valley home. But the story doesn't end quite so simply. The first inhabitants of the valley who tapped into the good fortune of an underground sea in the middle of the desert utilized the resource far more conservatively than the current inhabitants.

Record of human activity in the valley dates to as far back as 11,000 years ago. For the first several thousand years, nomadic groups used the region as bison hunting grounds when climatic conditions proved favorable. Evidence of agriculture in the region didn't surface until the Spanish invasion in the late 1500s. A variety of tribal people collectively known as the Ute people frequented the land during this period. The Ute people primarily relied on a hunter-gatherer lifestyle but planted small crops such as beans and maize. Although these people relied on the land and its resources, there was still no permanent settlement in the valley. It wouldn't be until the mid-1800s that true settlement took place with the introduction of land grants from

the Mexican government. At this point, the region started to trend towards more serious agricultural production with the introduction of an acequia, a community irrigation ditch, known as the San Luis People's ditch. Notably, this is the first official water right in Colorado. Agricultural practices at this time included long strips along riparian zones known as a *vara*, and production was focused at a subsistence level. Until Colorado's statehood in 1876 the residents of the valley led a pastoral life centered around farming and sheepherding (Huber, Larkin, 1996).

When the U.S acquired the territory, the government declared the Mexican land grants void and opened the territory up for homesteading, introducing several cultural groups into the region which had previously remained sparsely populated during the time of Spanish settlement. The influx of population highlighted a need that has continued to define the region to this day--the need for land and water. This need was increased with immigration to the region due to the discovery of precious metals and the introduction of railroads to seize the opportunity of striking it rich out west. Although mining was the premiere attraction in the valley, agriculture soon became a larger necessity in order to feed the draft animals used for mining. Local farmers given the proximity and freshness of their produce had the clear advantage. The prosperity of mining attracted many immigrant groups to the valley and spurred the creation of smaller towns such as Del Norte and Monte Vista. The height of the mining boom is responsible for much of the population increase in the valley. The five-county total population of the SLV reached its height of 45,000 in 1950 (San Luis Valley Council of Governments, 2015)

*Figure 3. Artesian well on Dutton Ranch, near Alamosa. Flowing sufficient water to irrigate 240 acres of land. Photo originally published in "The Tale of the Baca Land Grant in the San Luis Valley" 1909*

As the mining boom slowly transitioned to bust, much of the valley turned to agriculture as the next economic opportunity. Transitioning from mining to agriculture in the middle of the desert turned out to be easier than one would think. Water laws first came into existence with the mining industry. In order to sort the ore, miners would claim rights to water, which the law upheld by the principle first in time first in right. The first to lay claim to water therefore had a right to as much as they might need, and other water users wouldn't be able to satiate their right until the senior water right holders had satisfied their needs. This simplistic

principle would become the water law for the entire western half of the United States (Johnson, DuMars 1989). This all would've been well and fine if there was enough water to go around for everyone, but as you can imagine, water rights ran out quickly in such an arid region. If surface water was the only water present, the farming capacity of the region would've been capped at a much lower number. Lucky for the farmers in the valley, an excess of water sat not far beneath their feet. The same first come first serve mentality was incorporated into regulation of ground water use, and for decades, agriculture in the valley thrived with the good fortune of the aquifers (Schlager 2006). For years agriculture reigned supreme in the region, accounting for 23 percent of the valley's income, compared to only 5 percent at the state level (Kemp, 2016). But as they say, all good things must come to an end, and so it went with the availability of groundwater in the valley.

At the turn of the 21st century, the unconfined aquifer groundwater levels began to decrease quickly. With 98 percent of farmland in the valley being irrigated, the aquifer dropped approximately 1,000,000-acre feet in the span of just five years (an acre foot being the amount of water it would take to cover an acre of land in a foot of water). The rapid depletion of the aquifer wasn't completely the fault of wasteful water users. At the same time the valley entered one of the longest droughts the valley has experienced in modern history coupled with many of the driest years in recorded history. The changing climate and over-appropriated water resources

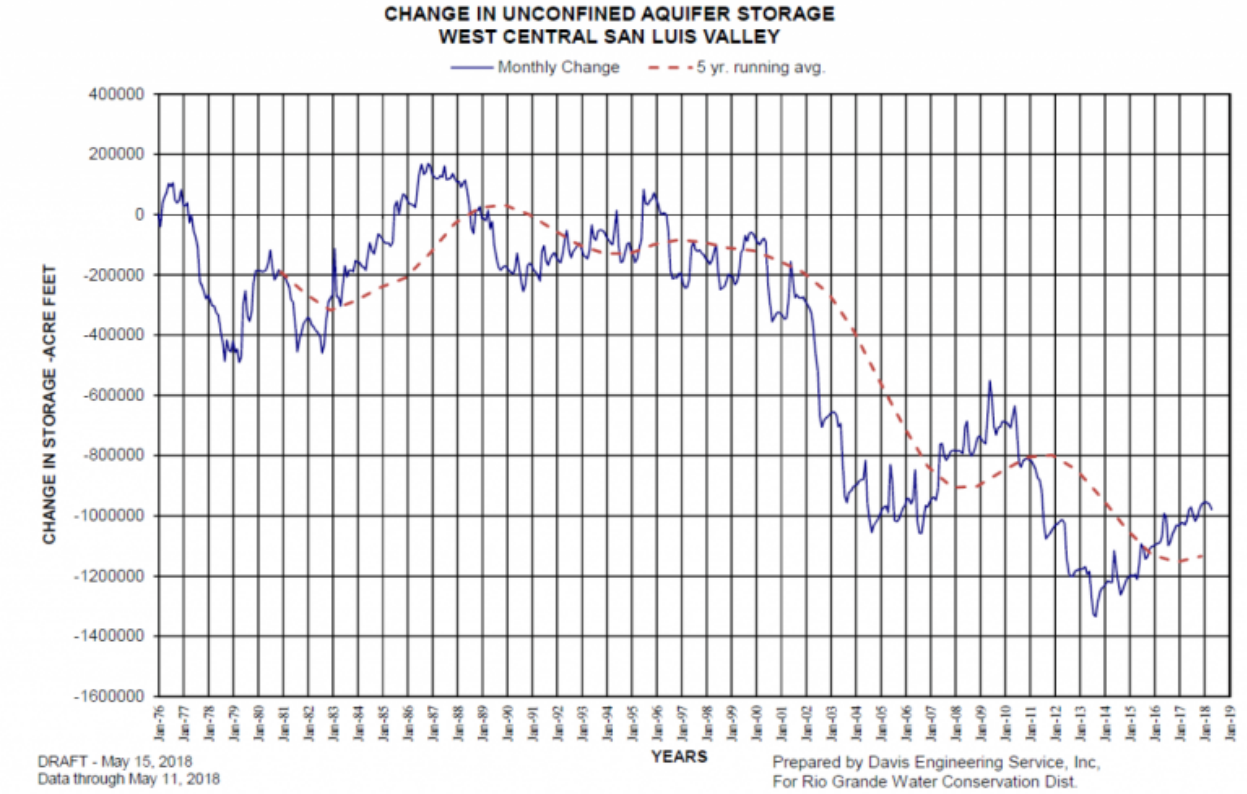


*Figure 4. Change in Unconfined Aquifer Levels from 1976 to 2019*

woke water users to their consumptive habits. Even if by law they had the right to use enough water to satiate their needs, the resource wasn't endless as many once had thought. If they continued with their old habits, they would completely extinguish the resource. It should be known that water users in the valley weren't working to change water use habits solely on their own accord. The state notified the water users that if they couldn't change their habits and replenish the aquifer to sustainable levels, they would step in and manage the resource on their own terms. The threat of state intervention and a dwindling water supply encouraged the water users to create their own plan for augmenting aquifer levels back to sustainable, pre-drought levels.

This plan is known as the sub district plan. The plan was to divide the valley into different districts based on the hydrology and geography of each district and create a detailed plan to manage water use. The first sub district to go live was sub district number one, the district that relies predominantly on the unconfined aquifer for irrigation. Subdistrict No. 1 was recognized as a legal entity in 2006. There are other subdistricts, but Subdistrict 1 had the most urgency and headway to make in terms of achieving sustainability. Many of the other subdistricts rely on the confined aquifer which has a more stable supply of water or they have access to more surface water rights. In this paper, I'll mostly be referencing the subdistrict program as it pertains to sub district no 1. The plan is to incentivize fallowing land and decrease groundwater pumping. Irrigators in the region have the option to join the sub district to collectively work on increasing aquifer levels or go to the state and create their own augmentation plan which is a lengthy and complex process. Currently, almost all irrigators have opted to join the subdistrict. The subdistrict has been functional since 2012, but with one of the worst drought years in recorded history in 2018, there has been no net gain of aquifer levels. While the subdistrict still has approximately 10 years to reach the sustainable level they approved with the state, it seems almost impossible that the subdistrict will reach their goals (Simpson, 2019).

This history of water depletion isn't uncommon. In most of the western United States, pioneers came out in search of good fortune and new adventure. The land and resources have been milked for what they were worth and soon they may not provide so fruitfully. The descendants of the first pioneers, many of which still dwell in the valley, will have to face a dilemma of continuing with the family tradition of farming or move elsewhere in search of better fortune. Deeming that the end of the story for the San Luis Valley, however, would be jumping

to conclusions. The system of water law is what has made this tragedy of the commons trope such a widespread tale of the west, especially for those who rely on water for their occupation. Although the subdistrict system has a high likelihood of not achieving its goal, it is challenging how we interact with traditional water law and how a community can challenge a broken system of common resource governance. Whether successful or unsuccessful the story of trying to save a finite resource is pertinent to everyone who participates in the food system. This frantic grasp at salvaging a smaller agricultural economy may allude to the fate of the western agricultural economy at large. While the story of depleting groundwater and failure to manage a common resource has been told before, it's important to listen to the story of the San Luis Valley because their current struggles will be the struggles of our future. Throughout my research I have conducted a series of interviews with groundwater users in the valley as well as water professionals to better understand the status of the valley and the work being done to create a more sustainable future for the region. With the assistance of these in-person interviews I analyze how western water management is being challenged and the efficacy of change which has taken place and above all how it has affected the lives of those who make their living off of the water and land.

# Literature Review

The resource issues faced by the residents of the San Luis Valley are faced by many other regions throughout the world. Managing resources is a challenge, especially when working with open access or common resources. In Garret Hardin's 1968 piece, Tragedy of the Commons, he

conceptualized this challenge through an allegory of herdsmen grazing their animals in a shared meadow. Hardin theorized that each herdsman would try to keep as many cattle as possible on the pasture. With the addition of an animal to the pasture, the farmer is faced with one positive and one negative: the positive being the farmer receives the entire proceeds from the sale of the animal, but the negative is they contribute to overgrazing of the pasture. However, the individual benefit greatly outweighs the collective negative because the overgrazing is shared by all of those who use the pasture (Hardin, 1968). The farmer wanting to maximize profit from his herd will add more animals. It should also be assumed that every herdsman that uses the meadow will reach the same conclusion and add more animals to their herd. This trend will continue until the cumulative negative outweighs the individual positives experienced by each herdsman. Stepping back from this system is the most difficult part. Each herdsman was conceived to be locked into a system that compelled them to increase their herd without limit. And such was the tragedy, there was no easy way out. "Freedom in a common brings ruin to all" (Hardin, 1968). Hardin's theory has been widely applied to many common pool resources such as air quality, fishing and water use. Much of Hardin's argument rings true with the case of groundwater in the San Luis Valley, yet many have criticized it for being over-simplistic.

Hardin's argument was challenged and complicated by Elinor Ostrom (1990) in her book *Governing the Commons*. Ostrom demonstrated how commons in the real world had not led, and do not inevitably lead to tragic ruin. Ostrom argues that Hardin's "allegory conflated the idea of a scarce resource with the governance of that resource, and it further conflated open access with commons, despite significant differences in those forms of governance" (Frichmann, Marciano, Ramello, 2019). Essentially, Ostrom sought to answer if commons in real life follow Hardin's model and if Hardin's model was the norm or the outlier. She found that this original model was

indeed the outlier because Hardin did not account for communication between participants and the possibility for some form of government. Complete open access without regulation almost never exists. These factors change management practices of the common resource. This was shown in Ostrom's analysis in game theory. Ostrom explained:

"Making one small change . . . in the structure of laboratory experiments, a change that is predicted by game theory to make no difference in the predicted outcome, has repeatedly had major impacts on interactions and outcomes. Simply enabling subjects to engage in face-to-face communication between decision rounds enables them to approach socially optimal harvesting levels rather than severely overharvesting the commons. In face-to-face discussions, participants tend to discuss what they all should do and build norms to encourage conformance" (Ostrom, 1997).

While Ostrom's findings illustrate a more nuanced, regulated and successful reality for common pool resources, it's important to recognize that not all open access and common resources are managed successfully because there is communication and governance. The reality is, sometimes commons are managed successfully and sometimes they fail. Ostrom emphasized that communities are still embedded in government, natural pressures and market systems which make the successful governance of common resources vulnerable to outside pressures.

At this point, it's important to recognize the resilience of the common resource in question and what a potential tragedy of resource management would mean. With a meadow, there may be over grazing to a tipping point and the farmers will suffer economically until they can balance their grazing practices with the carrying capacity of the meadow. Overfishing and air pollution are effectively mitigated in the same manner. In those examples, pertinent players can modify their behavior to get a quick response within the system. Water, however, is

different. Groundwater is effectively a non-renewable resource. The aquifers which modern farmers in the SLV rely upon were filled with thousands of years of snowmelt. In the case of the San Luis Valley, the unconfined aquifer is rechargeable, but not in the time span of a few years. It would take an extended period of no water withdrawal for the aquifer to return to pre anglo settler levels. Although technically groundwater is renewable, the extensive recharge time makes it functionally a non-renewable resource. Many people think that groundwater is replenished by rain and snow much like lakes and rivers, but groundwater is renewed much more slowly. Globally only 6 percent of groundwater is rechargeable within 50 years (Gleeson, 2016). In acknowledging the non-renewable nature of groundwater, we can better understand the stakes held in the potential of groundwater management resulting in failure. If managed unsuccessfully, the result won't be a few years of economic hardship on the part of the farmer or economic diversification within the region at stake. It would be a decisive end to agriculture for the foreseeable future.

With the understanding of common resource management theories and the nonrenewable nature of groundwater as a resource, we can now look how the governance of water in the west has shaped the current state of water availability. As mentioned beforehand, western water law was initially shaped by the gold rush. Local courts created more water regulation during this time since there was a rapid increase in population. They needed a better way to regulate the chaos of the initial westward movement and created a first-come-first-serve system for water rights. Since most property was far from streams and there was little rain, officials then gave settlers formal rights to take water out of rivers and move it across dry land where it could be used to mine minerals or turn rocky fields into farms. As western territories became states, those states institutionalized the rules — sometimes in their state constitutions — first locking in water

rights for those who were already there and then issuing more to those who requested them (Sax, 2007). Several water negotiations were made by the western states such as the Rio Grande Compact which includes Colorado, New Mexico and Texas as well as the larger Colorado River Compact which includes Mexico, Wyoming, Colorado, Utah, New Mexico, California, Arizona, and Nevada. These negotiations were set up to divy up water resources throughout the western states which has long been an issue of high contention.

In these compacts, the water was highly overallocated. The Rio Grande basin is mostly an arid region. In order to maintain a viable agricultural economy in this region, the river has been stretched beyond its capacity. It's estimated that the annual flow of the river is approximately 2.6 million-acre feet (Udall, Overpeck, 2017). Between the U.S. and Mexico, which has rights to 60,000-acre feet of water per year, the basin uses up almost the entirety of the annual flow. Many years, the river doesn't even reach the ocean (Congressional Research Service, 2018). On top of an over appropriated system the annual flow has steadily decreased since in 1990 (Khedun, 2012). The Colorado river has experienced a similar fate. Today, 16.5 million acre-feet of water have been allocated, while the river, during the recent drought, has been flowing at a rate of around 12.4 million acre-feet each year (Udall, Overpeck, 2017). Despite this obvious miscalculation of water availability, neither of the compacts have drastically changed from their original version or fundamentally changed the foundations of water law that has led to overuse. The result is governing principles designed for a different era and a general lack of accountability for the management of the resource.

The regulation of groundwater was handled in almost the exact format. Anyone could dig a well and use as much water as needed and under western water law, depletion of groundwater is not thought to impact the water rights of those who rely on surface water

(Swenson, 1986). Today in the High Plains and Central Valley 60 percent of irrigation relies on groundwater. Strikingly, groundwater depletion in the irrigated High Plains and California Central Valley accounts for 50% of groundwater depletion in the United States since 1900 (Scanlon, 2012). In review, although this common resource has an overarching system of governance through different compacts and a record of priority access, the resource is pressured and viewed in a way that often encourages overuse.

Recently, water users have received feedback from states especially in relation to groundwater. In the case of the San Luis Valley, the Colorado state engineer mandated that the unconfined aquifer level be recharged to pre-drought levels. A factor of this mandate's creation is each state's duty to fulfill interstate compacts. The Rio Grande Compact says that each state must send a certain percentage of the river's flows to the next state. If the required flows are not sent downstream for the next state's use, then each state risks the danger of being sued. (Interstate Stream Commission). If the aquifer is depleted extensively, surface water will be sucked into the aquifer from the Rio Grande which increases the risk of Colorado violating its contract to deliver agreed upon flows. By mandating an aquifer level increase, the state engineer isn't exclusively looking out for the wellbeing of the resource so the agricultural economy in the valley has longevity, but he is partly exercising his responsibility in upholding the Rio Grande Compact.

The Colorado state engineer has shut off well pumping in a predominantly agricultural district in the past. During an intense drought in the early 2000s, the engineer shut off hundreds of wells in the South Platte region (South Platte Implementation Plan, 2015). Although farmers in the area had aquifer augmentation plans, they were unsuccessful. Water users in San Luis are desperately trying to avoid this fate. Their attempt to restore the aquifer and their decisions of

regulation will be the last determining factor if the resource is successfully managed or if its use will result in tragedy for those who rely on it.

A recent case study conducted in Idaho looked at farmer adaptation to groundwater shortage. They found that farmers were attempting to successfully govern resource use by creating several water districts and mandating each district cut their use of water. Overall, respondents of the study cut their water use by an average of 11.9 percent. The impact of this cut was an average yield loss of 7.9 percent and an average income loss of 8.6 percent. Given this agricultural region has a similar crop makeup as the San Luis Valley and similar groundwater shortages, this study is helpful in predicting certain outcomes the subdistricts in the SLV will experience (Running, 2019).

In summary, water in the west has been highly over appropriated and steps toward successful government management have been overlooked until recently when it has fallen into the hands either state or local governments. With Ostrom's theories on managing the commons, we now look at the efficacy of local water management. As Ostrom stated, often communication in relation to a common resource isn't enough to successfully and sustainably manage it. With almost a century of little to no effective management and ramping climatic pressures, local water managers have extremely high stakes and lots of ground to make up in order to find a balance between viable use and tragedy of the resource.

# Findings

I drove down to Alamosa, Colorado without much of an idea of what I wanted to accomplish and even less of an idea of who I wanted to talk to. I had scoped out a few community agriculture meetings that I planned on attending and I hoped that small town friendliness would help me create more contacts. At first, it felt uncomfortable to ask a room full

of people who already knew each other if they could take an hour or so out of their day to talk to me about the troubles they face in relation to their livelihood. Some farmers jokingly asked me if I had come down here from my college to give them the answer to the big mess they are in. While it was only a joke, they emphasized my greatest insecurity while doing this research. I only knew the basic knowledge of the crisis they are facing. I had no intention of offering a resolution and I relied greatly on my interviews to educate myself on the reality of the issues farmers in the SLV deal with. My goal with conducting these interviews was not to emphasize the wrongdoing of farmers or the subdistrict but simply to gain insight into how managing water use at a local level has changed the lives of producers and those who work along producers.

To understand this change, it is essential to understand the plan under which they are currently managing their water. Melissa Fricke works as the program manager at the Rio Grande Water Conservation District (RGWCD) which is the entity that enforces the subdistricts. Fricke explained that the conservation district works under two main operatives from the state. They must continue work to meet their water sustainability goal which was approved by the state and ensure they are making no depletions to the river. As long as they are meeting those two mandates, the subdistrict has essentially taken matters into their own hands (Fricke, 2019.)

Cleave Simpson, the general manager of the RGWCD, says operating under their sustainability goals has been extremely difficult for several reasons. For one, the participation expected and necessary for the district to meet their sustainability goal has not been achieved. The sub district was created in 2006 but due to a series of legal troubles, the sub district didn't officially start operations until 2012. The plan for aquifer recovery was created in partnership with the USDA farm services agency. More specifically, the USDA endorsed a program called CREP. The concept of CREP was to put 40,000 acres of previously irrigated land out of

production for 15 years. Those who took their land out of production would be compensated with $500,000. If the subdistrict could get enough willing participants, then the USDA predicted the aquifer would achieve sustainable levels within 20 years. However, producers in the valley were less than thrilled with approaching aquifer recovery in this fashion. For one, producers were unsure what would result from letting the land fallow for such a long period of time. Secondly, commodity prices at the time made it difficult for producers to buy into the fallow plan. Simpson says he was thrown back by the lack of participation "That was the foundation for our success. Originally, it was what the model was built around." But because there was limited participation, the sub districts created their own program to incentivize land fallowing.

The RGWCD found that the most unpopular element of the CREP program was the amount of time required for fallowing. Producers were more interested in a program that would allow them to alternate which parcels of land they were fallowing and they wanted to fallow for less time. This pilot program sponsored by the subdistricts would pay the same amount as CREP with the same time frame of participation. Participation increased with the edited program and 2013-2017 the aquifer levels steadily increased. In 2018, this progress was halted to a stop with the fourth worst drought in recorded history. Simpson said "it basically reset the clock and put us back to where we were in 2012." But because they had decreed to the state that they would reach prescribed levels within 20 years, they then had only 12 years to reach that same goal, even though they were essentially starting anew. It's at this point when the Colorado state engineer notified the subdistrict that if it appeared they would not reach their goal within the next 12 years, he would be put in the unenviable position to shut off well operation within subdistrict one. As of now, the subdistrict has approximately 10,000 acres out of production as compared to their initial goal of 40,000 acres. The district is still striving to find ways to incentivize

fallowing with programs such as the half fallow program which allows farmers to take only half an acre out of production and they've increased fees on pumping groundwater. Initially, fees for groundwater were $45 per acre foot. With no net gain in aquifer levels, the subdistrict increased this fee to $90 per acre foot. Desperation seems to be increasing each year and this upcoming year's fees are predicted to be at $150 per acre foot which has caused some producers to question if they can afford to continue farming. Simpson has land outside of subdistrict one, so he is not subject to the same fees as producers in subdistrict 1 but acknowledged the difficulty of keeping up with such a high fee. "If I had to pay $150 dollars an acre foot, my farm would not be profitable, but the reality is we here suffer from an imbalance that our demand exceeds our supply" (Simpson, 2019).

George Whitten, a producer within subdistrict 1 and a board member of subdistrict 5 shares the idea that such a scarcity problem would be inevitable with the current resource supply and demand imbalance. In my conversation with Whitten he deeply criticized how agriculture had been set up in the valley. Whitten emphasized that wells were specifically drilled to cover producers in years of drought. With such a long sustaining drought due to climate change, wells have become a major source of the economy and our system of growing food. "That's the problem, the functionality of our agriculture system is not true sustainability. Subdistrict 1 is not sustainable and they're not going to get sustainable." Eventually, because subdistrict one relies economically on groundwater, they'll have to overcome that "and that is such a huge economic burden that it's insurmountable. Subdistrict one is starting to eat itself from the inside…our life doesn't even make sense in the economic reality of subdistrict number one. There's no way I can justify using water that's worth $150 and acre foot to raise cattle".

Whitten also acknowledged that the water these days is not just valuable to producers such as himself. Whitten said "You have the outside need for water like the Front Range and all the development out there. That is an even greater demand on a resource that suddenly makes it so valuable that it doesn't make any sense for people like us to have it. We're not doing anything with it, we should just take it away because we don't know how to use it. In that sort of cultural context, we don't make sense anymore" (Whitten, 2019).

Whitten's comments are highly relevant to the times. The valley has been subject to many water export schemes to support the front range's growing population. All have been unsuccessful but that hasn't stopped Denver water company Renewable Water Resources from attempting to purchase water out of the valley. All the farmers I talked to said they were against it which is pretty much the only acceptable public stance. However, many of the producers said with such difficult economic times, it would be understandable as to why someone might sell their water rights to make ends meet. Whitten specifically said that he thought RWR would be successful this time in their quest for water saying, "there's only one time when water flows upstream, when it's heading towards money."

Not all farmers share the belief that water exportation will take priority over their livelihoods and most are desperately trying to build a future for themselves. Dale Barty is one of these farmers who said he has to hold out hope that it'll all work out in the end. Barty is a fourth-generation farmer and maintains an operation of alfalfa, potatoes, flax and cattle.

Barty doesn't have any surface water rights so the increased pumping fee is drastically affecting his operations. So far, he has been trying to figure out how much of his land he can farm with the increased fee. The fee has not yet been approved for the 2020 growing season and Barty said he hopes the fee won't be approved. "I don't know what I'm going to do. I'm very

nervous, it's nerve wracking to figure out how you're going to make it work," Barty said. Many farmers in the subdistrict are under similar circumstances and he expressed how concerned he is for their collective future. "How do we take this and make it work? We're barely even breaking even now. You know, are we doing this for our health? Just to increase our stress levels and see if we can keep going? Are we just going to do it until we're forced out and then go bankrupt?" I asked him if he thought he would continue farming until he is forced out if it ever comes to that. Without hesitation he said he thought he would, but he is changing his farming model to appeal to organic consumers who value a farm to fork model. I asked him why he chooses to farm when he could have a more stable career. He replied "Because I love it. It's freedom for me. You know, I've worked for other people. I didn't like the nine to five. It's just a way of life, it's a way that I love." While Barty has cut back on his water usage to make ends meet, he said other producers who have surface water rights, which have no fees, have not cut back which has put an unequal burden on groundwater users to resolve aquifer depletion. Essentially, the only option for producers who rely on groundwater is to participate in the subdistrict fallow plan. In his opinion, this is a form of welfare, the district pays you, so you don't farm. Barty said "the worst thing you can do for an economy is take it out of work" (Barty, 2019). Whether this be true or not, it became clear after my conversation with farmers that the last thing they wanted to do was stop farming. It is a lifestyle they enjoy, cherish and feel is valuable to society. But how do you solve a groundwater crisis when no one wants to give up farming altogether, when that's really the solution the crisis calls for. Cleave Simpson realizes that despite years of community meetings and legal battles to create a plan that can create a sustainable future for farmers in the subdistrict, control is largely out of their hand expressing "in the end, mother nature will determine whether it works or not."

# Analysis of Findings

So, what does it matter if this agricultural valley is successful or not? Regardless of failure or success, water management is trending away from the laissez faire mentality which has governed it since westward expansion. The catch is that states are only giving control to local governments when depletion of the resource is so great that it threatens to interfere with interstate compacts. Essentially local governments only get the opportunity to manage resource-use when it's at a stage of imminent failure. As producers from the valley highlighted, these programs can be community driven and designed but shortcomings will always be present. In the case of the subdistrict program, a culmination of market pressures, legal delays, and dry years has put the program in a position where success is not likely. I do not believe that it is a mindset of ambivalence towards the resource or lack of care for their future that has put the subdistrict in this unfortunate position. As Ostrom argued, governance of a common resource is most successful when users are communicating with intention to reach a socially optimal harvesting level. Despite this taking place, the producers can't seem to buy enough time and create a sufficiently efficient system that would allow sustainable use of the aquifer. I would argue that the world is entering a new stage of common resource governance that complicates Ostrom's theory of effective communication leading to successful management. I argue that governance of a depleting common resource will almost always be unsuccessful under the current circumstances of when community governance is able to take place. One of the main themes I took away from talking to the producers of the San Luis Valley was that they wanted to continue farming. The subdistrict plan is the current means to continue their way of life. I cannot speak

directly for the producers, but I believe they are willing to make the required cutbacks to continue to do what they love. If ceased agriculture production is the only way to preserve the resource, I don't think many farmers would make that sacrifice for the sake of resource preservation. Perhaps the plan is more of a way to stretch the time they are able to continue with their occupation rather than find a resolution to the problem. Yet keep in mind, this is my analysis of their personal intentions. Nevertheless, farmers are making huge sacrifices and enduring great difficulties in attempts to continue production.

As mentioned throughout this paper, the San Luis Valley isn't the sole place where groundwater depletion is occuring at an alarming rate. The high plains of America, known as the breadbasket, rely almost entirely on the Ogallala aquifer. Unsustainable use by the 8 states that rely on its ground water has threatened the region with economic disaster. The Ogallala Aquifer supports an astounding one-sixth of the world's grain produce, and it has long been an essential part of American agriculture. The aquifer is responsible for thirty percent of all irrigation in the United States and with such a heavy toll, the Ogallala Aquifer has long been unable to keep up with these agricultural demands. Similar to the San Luis Valley the aquifer recharges far slower than water is withdrawn. Irrigated agriculture is particularly straining on the aquifer as the region is responsible for one-fifth of the wheat, corn, cotton, and cattle produced in the United States. The High Plains actually leads the entire Western Hemisphere in irrigation with fourteen million acres irrigated annually, primarily in Nebraska, Kansas, and Texas. Accordingly, farming accounts for an astounding ninety-four percent of groundwater use in the region. While states are taking a variety of approaches to slow depletion, the great plains are still drying up (Frankel, 2018). This threatens the existence of entire towns whose economies rely on agriculture. The Ogallala is the largest aquifer in the U.S. so it's continued depletion will undoubtedly have an

effect on the entire food system in how we might produce food and the types of food we eat in the future.

This groundwater depletion crisis also plagues another agricultural powerhouse of the U.S.: the Central Valley of California. The Central Valley in California yields a third of all produce grown in the U.S. Severe droughts in recent decades have made the drilling of groundwater necessary to keep up with its normal agricultural production. As expected water in the aquifer has shrunk considerably, approximately 60 million acres since the 1960s (Ohja, 2019). If you're keeping track of the math in this situation, further depletion could lead to the regional failure of a sixth of the world's grain production, a third of the U.S's produce production and not to forget the San Luis Valley's contribution as the second largest potato producer in the U.S.

The point being, this is more than just a crisis that will ruin the lives of the farmers and the economies in these regions. This crisis has the potential to create a major food shortage worldwide. While today you can easily walk into any grocery store and see vibrant piles of carrots, peppers, lettuce etc, and have your steaks well marbled due to cows ripe off of the corn and soy of the bread bowl, these luxuries come at a cost of nearly extinguishing our most necessary resource. A resource that won't exist for much longer if we maintain our food consumption habits. While I wish I could wrap up this essay with an easy solution to it all, I'm afraid that doesn't quite exist. It's unknown if water district systems, state mandates or water markets will prove most effective in conserving groundwater. For now, many communities are experimenting with their newfound responsibility to manage the resource and trying to find a solution that best serves their priorities. As for the San Luis Valley, groundwater fees are still going up, corporate interest on the front range is still vying for the valley's water, and farmers

like Dale Barty, Cleave Simpson and George Whitten are still struggling to make ends meet. John Wesley Powell once said, "the East is a green America, but the American West is a brown land." (NPR, 2003). Powell hypothesized that there wasn't enough precipitation to sustain a thriving western population. The groundwater reserves proved him wrong for a good century or so but maybe he was right. As much as 19th century homesteaders believed that rain would follow their plows, they were sadly mistaken. Just as farmers are facing the realization that the reserves which sustained their great grandfathers will no longer sustain them for much longer, we must realize that the manifest destiny mentality which sustained the creation of a westward population will fail to sustain this society.

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