In a Precarious Place: Climate Change, Sociopolitical Change and Taos County Ranchers

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Abstract

This thesis discusses how climate shifts and sociopolitical change are impacting small-scale ranchers in Taos County, New Mexico. I collected data using participant observation, semi-structured interviews with ranchers and community members, and a review of the literature. The viability of ranching is threatened by a combination of factors including a warming, drier climate, commercial development, a changing labor market, an aging population of ranchers, top-down land management policies imposed by the U.S. Forest Service, and the historic loss of land grants during the 19th century. Small-scale ranchers are in a socially, economically, and environmentally precarious position. There is a need for additional research on the resilience of small-scale ranching in the face of climate change and other factors.
Acknowledgments

This thesis is dedicated to the ranchers and community members who so generously shared their time, stories, and expertise with me. Their care and knowledge of the land, water, and animals were inspirational. I am deeply humbled by the work of those I spoke to, and their stories will stay with me forever.

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I also want to thank my family, especially my mother, who supported me throughout this entire process, even from 450 miles away.
The discussion about water is becoming urgent. One man stands up to face the audience and states, “We’re concerned because 16 of our wells have gone dry already in the Lower Des Montes area...The climate has changed. We know that it’s changed. And we’re in a drought stage, you know that too. It’s happening around us.”

I am at the Lower Des Montes Neighborhood Association meeting in the cafeteria of a local elementary school in Taos, New Mexico. About twenty people sit around long cafeteria tables; the majority are Hispanic, male, and over forty, sporting blue jeans or Carhartts, work boots, and a mix of camouflage hunting caps and ten-gallon cowboy hats. On one side of the room sits a middle-aged Anglo attorney in a blue suit, thumbing through a stack of files piled half a foot deep. It is six o’clock on a Wednesday evening and people from Lower Des Montes and Arroyo Seco (communities northeast of Taos) have gathered in the school to discuss a pending proposal from two Illinois developers to build a 36-home subdivision, “Beausoleil,” on a 400-acre lot in Lower Des Montes. Each home will have a private, 30,000-gallon swimming pool. While the project has already received preliminary permission from the Taos County Planning and Zoning Commission and the state engineer, the purpose of this meeting is for members of the community to gather and express their concerns about the subdivision to an attorney, a neutral third party, so that he can communicate their concerns to the developers with the hope of delaying the final approval of the development to allow time for negotiation.

With sixteen wells in the Lower Des Montes neighborhood already dried up and the 2012-2013 drought still taking a toll on Northern New Mexico, the idea of building 36 private swimming pools in the area does not sit well with the Des Montes community members. Richard, the president of the Lower Des Montes neighborhood association, says the pools are
being used as a “marketing tool” to pitch the subdivisions as luxury homes, many of which would be vacation homes to future buyers. As one person at the meeting pointed out, one private 30,000-gallon swimming pool is equivalent in size to the community water tank for the entire neighborhood of Arroyo Seco. To local community members, the proposed subdivision represents a disturbing conception of the Taos landscape and way of life. One audience member stands up from the table and declares, “We’re in the middle of a major drought and yet we’re trying to use swimming pools as a selling tool to attract people that maybe we don’t want. Do we want people here who want swimming pools and who have no idea of how fragile this community is? I don’t think we do.”

Most residents of Lower Des Montes get their water from wells and irrigate any farmland they have from an acequia (community water ditch). The average depth of the existing wells in the area is 296 feet. However, the proposed wells for the subdivision are between 450 and 500 feet, costing $30,000 each. Many attendees of the meeting, who have already seen their wells dry up, are now drilling second or even third wells at greater depths. One man, whose property borders the potential building site, is on his third well. He explains, “My well went dry and so I drilled at 460-something feet, and two years later that went dry. Then I drilled another 700-something foot well and I didn’t hit water. I had to go to the other side of my property and drill 800 feet before I got any water.” Personal testimonies like these leave community members asking about the effect of 36 new 400 to 500-feet wells on existing wells, especially those that are “upstream,” or at lesser depths.

The attorney responded to this concern by stating, “I leave it to the scientists. Their studies have been accepted by the State Engineer’s Office.” And they have been. According to the impact study conducted for the development and accepted by the State Engineer, the test
wells drilled by scientists did not affect surrounding wells due to a new technology that prevents water from being drawn from upstream. However, these findings also indicate that there is only enough water to sustain the community for fifty years, which Richard thinks is probably an overestimate. He asks the audience, “You believe them? You really believe them?” Regardless of technological innovation, tapping wells to fill recreational pools is in stark contrast to the northern New Mexican proverb that, “el agua es vida,” or “water is life.”

Wells are not the only concern that Des Montes community members have about the development. Traffic, water rights, and the impact of the development on acequias were also brought up at the meeting. A member of a local acequia association attending the meeting noted that:

We get a lot of our water from snowpack and springs and what not. Ditches are real important in my opinion and what we’ve seen as a ditch association is in drought years, less snow. Look at last year, we almost ran out of water. We have the best river in Taos County, but what’s happening is [we have] a lot of farm acreage that is now being developed so there is less irrigation going around, and the acequias’ contribution to the aquifer is going down. So pretty soon there’s going to be very few acres being irrigated, and our aquifers, regardless of where we live, are going to keep going down and down.”

Acequias act within the northern New Mexican landscape similarly to arteries within the body. Acequia ditches capture water from a major water source, in this case the Sangre de Cristo mountains, and disperse the water over the land via a network of small ditches, delivering water to land that would otherwise not receive it. Water from acequia ditches not only irrigates the soil, but also effectively helps fill aquifers, as any water not absorbed by plants continues to seep down into the earth. However, if the role of acequias is reduced within communities due to the development of agricultural land or pools, for example, there is a lack of incentive to maintain the acequia ditches, potentially leading to their demise. Without acequias, lands in the lower watershed will lack irrigation, and the aquifers will suffer.
Of all the potential consequences of the subdivision, though, the overwhelming concern was adding swimming pools to a high desert environment that is already experiencing drought. Another audience member articulated this concern in his statement to the neighborhood association board:

Given the situation we’re in now with this drought, with the prognosis of this whole climate change, and that we could be in for a long drought, water is a really, really precious, finite, resource here. I just can’t understand in this community, in this environment, why someone would use swimming pools as a marketing tool. To me, it’s why I’m here. Because I don’t think in this part of this world, that swimming pools are something that a lot of folks really need. It’s taking a very sparse resource and it’s wasting it. My own feeling is that what we ought to be doing as a community is looking at ways that we can conserve water. Because my gut feeling is, ten years from now, we could be in real trouble.7

The meeting concluded with a show of hands of those against the swimming pools. Everyone’s hand went up. The members of the various neighborhood and acequia associations agreed to form a group to review the development’s covenants and draft a statement to the Taos County Commissioner’s office with the concerns and recommendations of the Lower Des Montes community in regards to Beausoleil. They also requested that the meeting of the County Commissioner for the final approval of the project be delayed until March.

As I left the cafeteria and was walking back to my car, one of the men from the meeting asked me, “What is a young person such as yourself doing at a meeting like this?” His tone expressed something between disbelief and suspicion. Feeling conscious of being an Anglo outsider of the community, I told him that I was a student doing some research on how climate change and other factors are impacting the ranchers of Taos County communities. “Well, it sure’d be nice to get some more young blood in here,” he said.

The Lower Des Montes Neighborhood Association meeting is emblematic of a crusade that many longtime residents of the Taos area find themselves fighting today—a battle to
protect not only the sacred land and water of Taos County, but also a set of values associated with the Hispanic culture that has characterized northern New Mexico for centuries. At the forefront of this battle are ranchers who breed and raise livestock, one of Taos County’s most historic and land-dependent sectors of the population. The threats that the Beausoleil subdivision pose to Lower Des Montes are largely the same as those that face ranchers in general in Taos County: water stress in a changing climate, a population composed increasingly of non-native, affluent Anglos and fewer native Hispanics, the imposition of top-down, technocratic regulations in a bureaucratic society, and a lack of understanding and respect by outsiders for local traditional entities such as acequias and small-scale agriculture. All of these factors contribute to a precarious or even threatened way of life for the longtime ranchers of Taos County.

Methodology

From an anthropological perspective, how does one study “a changing way of life?” This thesis analyzes a changing way of life for one particular sector of the Taos County population—ranchers—in the face of climate change and sociopolitical change. The term “sociopolitical change” in this thesis refers to the types of changes experienced by ranchers in response to both demographic change and top-down decisions made by government agencies, primarily the U.S. Forest Service, regarding land management. Ranching was introduced to northern New Mexico with the arrival of the Spanish in the sixteenth century, making it one of the longest practiced trades in the area (not counting those of Native Americans, whose existence long precedes the Spanish in New Mexico). Ranching lends itself to this study for both its historical roots in northern New Mexico and for the complex relationships it entails between different entities. Ranching extends beyond the relationship between people and animals; it is the relationship
between people and the environment; between people and their familial and cultural heritage; and more so now than ever, between people and the state and federal government. Indeed, ranching in Taos County is a part of a web, suspended within historical, environmental, social, economic, and political threads, making ranchers’ decisions to continue or not continue their work complex and irreducible to climate or sociopolitical change alone.

This thesis therefore seeks to understand how the conditions, culture, and viability of ranching in Taos County are changing in the twenty-first century in response to climate shifts and sociopolitical change, acknowledging that these changes are often interrelated and bound up in regional history. Additionally, this thesis addresses some of the current actions being generated by local northern New Mexicans, particularly ranchers and agriculturalists, in response to environmental and sociopolitical change. Such movements vary from the reemphasis of traditional connections to the land through farming, to lawsuits filed against the U.S. Forest Service.

I developed this research project with the intention of contributing to a much-needed bottom-up understanding of how the culture, conditions, and viability of traditional ranching fare in what one interviewee called “a changing Taos.” Northern New Mexico is a region that has always intrigued me for its obvious beauty, and for its historical and cultural depth. I frequently visited Taos growing up due to an acre of land in Arroyo Seco that my parents purchased in the early 1980s. As a child, Taos to me was a forested playground, a place where out-of-towners apparently came to enjoy themselves in the outdoors. But when I was older, I began to notice the subtleties of the Taos landscape, complicating my understanding of an area that has mobile home communities hidden behind art galleries and ski rental shops, old trucks loaded with hay bales cruising the streets, and Catholic adobe churches dotting the neighborhoods.
As I began learning about the hardships experienced in the region, including poverty rates significantly higher than New Mexico’s average, I began to wonder what lay below the surface of Taos County. What was this place like before the ski industry moved in, before Anglos like my parents decided they wanted a chunk of the land? My incomplete understanding of the Taos area, of its history, and of the people who have traditionally lived there is what led me to do this research. This thesis attempts to gain an understanding of the people, lifestyles, and culture of Taos County, and how external pressures are contributing to what is a changing Taos.

I collected data for this thesis using a literature review, participant observation, and interviews with ranchers and community members of Taos County. To understand the larger climatological and sociopolitical context in which ranching is situated today, I analyzed trends in climate, demographics, economics, and U.S. Forest Service policy for their impact on small-scale ranchers. I used the most recent comprehensive climate analysis, which examines climate change of the Rio Hondo watershed in terms of stream flow, temperature, precipitation, snowpack, and drought severity, utilizing records that go back to the late 19th and early 20th century. Supplemental climate data was gathered from newspaper articles, as well as from the United States Drought Monitor, a database managed by the National Drought Mitigation Center that releases weekly reports on state and regional drought conditions.

Demographic data were collected from the U.S. Census Bureau, the Northern New Mexican Economic Development Initiative, and from other demographic studies conducted in Taos County. Sociopolitical data, or more specifically, data relating to the impact that Forest Service policies have on northern New Mexican ranchers was largely obtained from the USDA report Social, Cultural, and Economic Aspects of Livestock Ranching on the Santa Fe and Carson National Forests. This report proved to be the most recent study of the U.S. Forest
Service’s management of Taos County’s local forest, the Carson National Forest (CNF). Information was also gathered from local newspaper articles and presentations given at the Northern New Mexico Stockmen’s Association meeting.

When evaluated in isolation from one another, climatological and sociopolitical trends in northern New Mexico do not provide an understanding of the implications of these trends on small-scale ranchers, nor do they adequately encompass the complex factors acting upon the communities of Taos County. Thus, to supplement the information provided by a literature review, I spent approximately two and a half weeks in Arroyo Seco, Taos, engaging in participant observation and conducting interviews with local ranchers and community members around the county. During this time, I attended local neighborhood association meetings, went onsite with a land conservation crew to do fire hazard reduction work, helped load hay bails and feed the cattle of a local rancher, visited the properties of the ranchers that I met, and attended the annual Northern New Mexico Stockmen’s Association meeting. I recorded notes from participant observation in a field notebook, which I referenced alongside voice recordings of select conversations and interviews with individuals who agreed to participate in the research.

I conducted eleven semi-structured interviews with local ranchers and community members of Taos County. Eight interviews were with ranchers, and the remaining ones were with a journalist from The Taos News, the Taos County Extension Agent, and an expert in northern New Mexican agriculture. All ranchers were over the age of forty and male, and the majority were Hispanic. Half of the ranchers interviewed were veterans, having served in the Vietnam War. Most ranchers raised cattle, although a couple kept either sheep or lamas in addition to cattle. The exact number of cattle per rancher was not collected (I learned this is an offensive question, equivalent to, “how much money do you have in your bank account?”).
However, the average number of cattle kept by ranchers in Taos County is between 30 to 45 head per rancher. All ranchers interviewed have been ranching for a minimum of twenty years, and in most cases, their entire lives.

The setting of each interview varied. In some cases, I visited the interviewee’s house or workplace. In others, I asked questions while in the car with a rancher on the way to feed his cattle. I asked questions pertaining to how the experience of ranching in Taos County has changed over the years. Many times, I simply listened as the person told me his story. My use of a voice recorder during the interviews was also situational. Some interviews took place in a quiet setting that was conducive to recording; however, many conversations took place outside where it would have been difficult to record.

To recruit participants from the community to interview, I began by sending out emails to community organizations and experts involved in the fields of agriculture and land and water conservation. One of the first emails I sent was to the El Salto FireWise Community, a neighborhood group that conducts fire hazard reduction work in Arroyo Seco. Two people from this community involved in ranching and conservation work responded to my email, agreeing to be interviewed. After I made these initial contacts, my recruitment followed the “snowball” method, in which initial contacts are asked to help identify other individuals in the community with “similar characteristics or from the same subgroup of the population” who may be willing to participate in an interview. This method proved particularly effective, and I was able to obtain the majority of my following interviews by referral.

Taos County: The Setting

Taos County is culturally distinctive in that it is one of the longest continuously occupied
areas in the country, making it a place where the relationship between people’s work and the land can be evaluated over the course of centuries. Human occupation of Taos Valley began with the ancestors of the Taos Pueblo Indians, whose presence in the valley reaches back to almost 1,000 years ago. The Taos Pueblo, which is still occupied and used today, was built sometime between 1000 and 1450 A.D. Beginning in the sixteenth century, Taos also became home to Spanish and Anglo settlers. In 1540, Capitan Hernando Alvarado, a member of Francisco Vasquez de Coronado’s expedition, first stepped foot in the Taos valley, marking the beginning of Spanish presence in the area. In 1615, Don Juan de Oñate, the first Governor of what is now New Mexico, established Taos as an official village under the Spanish crown. However, it was not long before Pueblo forces drove the Spanish from northern New Mexico for twelve years in the Pueblo Revolt of 1680.11 The descendants of the Spanish and Puebloan people who occupied Northern New Mexico during the Spanish Colonial period compose the Hispanic families of Northern New Mexico today. As clarified by McSweeny and Raish, “The terms ‘Hispanic’ and ‘Hispano’ are used to refer to residents of the southwestern United States who are descended from Spaniards who settled in the region prior to the U.S. annexation.”12

Taos County has a current population of 32,779 people, with 60 percent of the population living in rural areas.13 Taos County is often referred to in literature as “land-based,” and while the county is ranked near the bottom of New Mexico counties in terms of total number of livestock, ranching is part of a cultural heritage, especially for the many Hispanic families that have been ranching for generations.14 Taos County contains 637 farms, with a total of 456,932 acres, and an average farm size of 717 acres.15 In 2011, Taos County produced 11,000 tons of alfalfa, and 1,000 tons of hay, the two primary crops of the county.16 Additionally, the county listed a total of 500 head of sheep and lambs (second to last of all 33 counties in number of
sheep), and 6,700 head of cattle and calves (18th in the state in number).17

From these numbers it is clear that today’s agriculture and ranching operations in Taos County are modest, with the majority of farms being classified as small-scale farms, or those with annual sales of less than $10,000.18 According to the New Mexico Department of Agriculture, the average net farm income for Taos County in 2011 was minus $521, meaning that farmers and ranchers are operating in a financial deficit.19 This statistic sets Taos County financially apart from other New Mexican counties that practice large-scale agriculture, such as Curry County, whose average net farm income is $137,119.20 Aside from generating hundreds of thousands of dollars in sales, agribusiness farmers and ranchers are largely protected by crop insurance in the case that they lose their fields or animals to drought and other environmental disasters.21 In contrast, one small-scale Hispanic rancher explained that, “It wouldn’t make sense for me to insure my animals and hay crop because I would be spending more money than I’d be making. And then there’s all this paperwork and rules where you have to file the claim within a certain amount of time of the drought, which is sometimes hard to do.”22 Thus, the kind of ranching found in Taos County encompasses an element of economic fragility not found in commercial agribusiness.

Another factor that prevents small-scale ranchers in Taos County from more fully entering the marketplace is the high cost and time invested in obtaining USDA certification on their meat, which requires ranchers to transport any animals they want to sell to meat auction sites across the state (where additional fees are paid for processing) or to Texas. Furthermore, while Taos ranchers have always traditionally raised grass-fed beef without hormones and pesticides, many are unable to enter the organic marketplace due to the stringent stipulations required for organic certification, including the completion of a three-year, bureaucratic process.
and a large fee. While these requirements are easily met by large-scale farm and ranch operations, they are unrealistic for individuals who mostly take care of their animals by themselves. Ironically, this results in ranchers being unable to tap into a market that they have essentially been a part of for decades.

Indeed, while many of the interviewed ranchers reported that their grandparents and great, great grandparents were full-time ranchers before New Mexico became a state, they assured me that nobody in Taos County is a full-time rancher anymore. Rather, ranchers described ranching as a hobby, “a way of life,” or something they continue to do despite the fact that “it doesn’t really make you any sort of money.”\(^{23}\) In fact, the 2006 Economic Profile Statistics for Taos County report 66 percent of the working population are in the service sector (tourism, education, health, utilities, etc.), 14 percent are employed in the local government, and zero percent are employed in the agricultural, forestry, fishing, and hunting sectors.\(^{24}\) This data marks a decrease from the 4.4 percent employed in the agricultural, fishing, hunting sectors reported in the 2000 U.S. Census Bureau.\(^{25}\) From these statistics it is apparent that ranchers, as well as other kinds of agriculturalists, are increasingly making a living through other means of employment, so that ranching in Taos County is an activity that holds more social and cultural capital than it does economic remuneration. A schoolteacher that I spoke to explained, however, that occupational changes began long before 2000 in Taos County. He believes that World War II was a turning point in which unprecedented numbers of people made the transition from subsistence-level agriculture towards what was perceived as a more modern lifestyle:

Until World War II, people were still land-based, and they were still able to figure it out. But then WWII came and we got exposed to the world ourselves, and so then our values changed. At the same time, we were noticing people coming over here to Taos and they could afford generators, lights, and all that stuff, so people started to consider themselves poor and wanting these other things. And their subsistence lifestyles were then seen as characteristic of poverty and they wanted better for their kids. Now, my grandparents
were some of those people. My grandmother was a teacher, and my grandfather was a
construction worker… and my grandmother would wear on her sleeve that she was
educated, that she was using her mind to make money as opposed to her body and so then
that was then imparted to my mom. My grandmother almost got a master’s degree and
my mom did get a master’s degree. So my mom always wanted me to be an engineer.  

Another area in which Taos County has experienced dramatic demographic change is
population. In the last six decades, the population of Taos County has increased by 92 percent. The demographics of “in-migrants” to Taos County indicate that the majority are “older, Anglo,
and wealthy people looking for ‘lifestyle amenities,”’ while the “out-migrants” are primarily
“younger, Hispanic, and moderately poor people.” This trend has had several demographic
consequences, all of which have an impact on the viability of ranching and acequia communities
in Taos County.

First of all, the percentage of Hispanics in Taos County has decreased sharply over time,
despite the growing percentage of Hispanics and Latinos seen in the rest of the state of New
Mexico. While 69 percent of Taos County was reported as Hispanic in 1980, Hispanics made up
only 56 percent of the population by 2010. Because ranching and the maintenance of acequias
in Taos County are traditionally Hispanic activities, this trend implies a decreasing Hispanic
population in small-scale ranching and the care of acequias. Carlos, a middle-aged Hispanic
rancher explained that, “Northern New Mexico is a Hispanic thing, we’re different than Cubans,
than Puerto Ricans, Mexicans, and everybody else. We have different roots, different cultures,
and different things. There’s no other place in the planet like it. And now its very different,
Sonja, very, very different. Up where I live [Arroyo Seco], we’re in the minority now, and we
were the majority.”

Secondly, Taos County has experienced significant aging over time. From 1960 to 2010,
the median age increased from 19.6 years to 45.2 years, more than doubling the median age of
the county. In comparison, the State of New Mexico had a median age of 36.7 in 2010. The average age of Taos County’s principal farm operators is 59.4 years old, and the Northern New Mexico Regional Economic Development Initiative reports that, “a new generation of farmers is lacking.” Indeed, many of the ranchers I interviewed were either close to retirement age, or retired already. The concern over the lack of youth involvement in ranching and agricultural activity was a sentiment shared in interviews. Carlos is the only one of his siblings still ranching, despite his family’s 400-year tradition in this occupation. He commented that:

My grandfather said, ‘I want to you to carry on the tradition.’ And I says to myself, this guy is crazy, my grandfather, because I was too young. I was interested in some other stuff and it was a lot of work. I went off to the military. I came back. And then my mom pretty much pushed me more to carry on the tradition…The only thing is that, like my grandfather said, the new generation that has come in don’t give a damn. That’s probably the only word of English he knew, that ‘they don’t give a damn.’ I was talking to somebody the other day in church, and… the guy said, ‘you know what, [Carlos], those pews are all full now, but its older people and once they die this church is going to be empty.’ And these acequias, so on and so forth, nobody cares about them.

Times are changing. Ranching has become more technical…Very few people understand or appreciate the thing that we don’t see that we breathe and the water that we drink and the land that brings what you eat. See, people don’t have a concept—they think that there’s a magic person behind Albertson’s or Wal-Mart or so on. There’s a big detachment and it’s a point that people should be taught in school.

Carlos raises an important question. Is the appreciation and respect for the water and land something that can be instilled in young people through teaching in school, or is it attained through physical interaction and familiarity with the environment? Furthermore, to what extent is the appreciation and desire to interact with the natural elements transmitted generationally? In conversation with Richard about his 98-year old Hispanic father, it is apparent that ranching sheds some light on these questions. Richard described his father’s love and mastery of agriculture, and the impact his father had on his own connection with the land:

I don’t think there’s anybody in the whole world that loves water like my dad. He loves water. He can’t see a little trickle going without making it go to where something’s
going to grow. That’s how he irrigated all his life. He’s 98 years old… I see myself a lot like him I think. Because to him, to me, [the joy] is when you have a bare field, and then you [help] something [grow] out of that field. And you wanna be there to see it grow, then you want to get that water to every single piece.

My dad is like the best irrigator in the world. Because when you look at that field, you’ll see all green. All green. Not one [brown] spot. Now when we irrigate, you’ll see spots here and there. But he will take the time to make the water get to where he [wants it] to go. And I think the reward is just seeing something grow. The green… It’s actually fun. To me, this is fun. The cows are fun. It’s nice to be out in the mountains and just go for a ride, and check on ‘em and break the ice, or whatever. But to me that’s a blast. And that’s probably ‘my spa.’

Richard’s description of his father illustrates that in addition to requiring love for the natural environment, ranching requires a level of mastery of regionally-adapted agricultural techniques that are only attained through working the land.

While some Hispanic youth may express an interest in continuing the ranching traditions of their families, one of the reasons for their missing participation in agricultural practices may be economic pressure to seek employment and higher education in more urban areas in an increasingly cash-based economy. Although Taos County’s poverty rates have dropped over the years (from 38 percent of the individuals living below the poverty line in 1969 to 23.9 percent in 2012), Taos County continues to experience high unemployment rates compared to the rest of the State. The years from 2008 to 2011 show the highest unemployment rates Taos County has seen in the past decade: the unemployment rate reached 9.4 percent in 2011, a level slightly higher than that of the U.S. in 2011, which never rose above 9.1 percent.

The experiences of the locals interviewed reinforce these statistics. Of all the ranchers interviewed who had adult children, only one had a child still living in northern New Mexico, and she does not ranch. One rancher’s son moved to Colorado to work with Comcast; another said that he does not know if any of his eight young children will decide to stay involved in
ranching. In one particularly poignant interview, a rancher responded to my question of “what do you see as the future of Taos ranching?” as follows:

That’s a tough one. I lost my son about two years ago. He was 22 years old. But he would have kept it going. I know he would have kept it. And my brother’s son, I think he will keep it going. My daughters, not so much. One of my daughters has a 12 year old and a 9 year old so they spend the summer with me, and this winter too. They love going with me to feed the animals. You know, they’re in the back of the truck throwing the hay off and irrigating. They love it. I mean they talk to their mom and say how much they love it. So I’m really, really hoping that [sigh]…You know, these boys, they’re straight A students but you know, I don’t really see them doing ranch work probably because even though as much as I want them to [pause] they’re too smart. What do we do? It’s not really that you’re gonna get rich. You might be property rich but you’re not money rich. But you let go, you sell one acre, you’ll never get it back, ever. So it’s just a blessing to have it and work it because that’s where our interests lie. We do whatever we can for the environment and put water back into the ecosystem. I believe in that.

Another rancher shared a similar story of being hopeful, but unsure about whether his grandchildren will continue ranching or not. He shared that, “I have my granddaughter…she comes here and she likes it. She rides horses with me. She goes with me. I say, you go to school, you get educated, number one. Don’t go marry a bum, and [you can ranch]. That’s the agreement we’ve got, I don’t know if she’ll stick to it or not.”

This last statement brings up another demographic shift occurring in Taos County that may also be contributing to a declining participation in agriculture: an upward trend in educational attainment. While only 63 percent of the Taos County population had a high school degree or higher in 1980, the portion of Taos County’s population holding a high school degree or higher rose to 88 percent by 2010. One rancher proudly reported that his daughter completed nursing school and is now a NICU nurse in an Albuquerque hospital. While the success of their children was unquestionably a great source of pride for ranchers, it is clear that the greater prevalence of educational opportunities available now compared to the 20th century makes agriculture only one of many occupations accessible to today’s youth. Additionally, as
established earlier, even if youth did show an interest in agriculture, the small scale in which it is practiced today in Taos County would likely require them to have an additional or primary job as well.

Of equal concern to ranchers as the out-migration of Hispanic youth from Taos County is the influx of affluent, non-native people into the area who lack an appreciation for the land and the water. As seen in the Lower Des Montes Neighborhood Association meeting, outsiders who do not respect Taos County’s water scarcity are a significant threat to *acequia* communities and the longtime ranchers and agriculturalists that depend on them. For example, a woman named Linda who had the potential to irrigate her land with an *acequia* ditch was unable to do so because a neighbor who had moved in a few years earlier had unknowingly built her house in a manner that obstructed the ditch, preventing water from reaching Linda’s property. Newcomers may also be unfamiliar with having neighbors who keep livestock. One rancher I spoke to is trying to continue the traditions of his grandfather, once the biggest sheep herder of northern New Mexico, by keeping a small herd of sheep on his residential property in Arroyo Seco. However, he expressed the difficulty of keeping sheep with the arrival of new neighbors from out of town:

I’m probably the only one left in Taos [who keeps sheep]...When my parents divided the property, they gave some [land] to my sister, to [all my siblings]. And they sold it. So then people moved in, and they bring their dogs... They killed my sheep, their dogs. They don’t contain them. I train my dogs from the time they’re puppies to be with the sheep, but the neighbors’ dogs aren’t trained. I say, you can’t let them in my property...But people sometimes can’t understand the reasons.

Aside from the physical threat to *acequias* and livestock that new residents and development can cause, ranchers also face the consequences of increased property taxes that result from the arrival of upscale housing and establishments, producing enough financial strain
for a rancher to reduce or sell off his livestock altogether. One rancher told me about his experiences with the rising cost of land in Taos County: “I tried to do the whole thing where I ranched on a leased piece of land but it’s too expensive. If I couldn’t have my cattle on [my friend’s] land, I would just sell them all. I couldn’t do it.”

The rise of property values is indicative of the increasing cost of living in Taos County as well. In 1965, an acre of land in Rio Hondo (northwest of the town of Taos) was valued at $1,000; by 1997, the land value was $40,000 per acre or more.

Perhaps most disturbing to the local community members and ranchers of Taos County is not a loss of monetary return, or the growing Anglo population, but a fear that current and future generations are lacking querencia, a sense of place. Querencia is a derivative of the Spanish verb “aquerenciarse,” which means to become fond of or attached to a place. I was introduced to the concept of querencia by Martin, a rancher and one of the most respected soil and water conservationists in Taos. He explained that querencia is “your placement on the earth, the cornerstone of your existence, in harmony with the land and the water.” While not easily translatable into English, querencia is described in the literature as:

The place where you want to be, the place where you know how to go about the tasks of daily life, the place where you feel you belong. It is yours because you care about it…Querencia goes beyond the promise of monetary return. It implies a reciprocal, symbiotic relationship. It belongs to both the human and the animal realm, defining a special relationship that crosses the boundary between man and animal, encompassing both.

Querencia seems to be at the heart of the local community members and ranchers of Taos County. It is a set of values instilled within families, and the responsibility that northern New Mexicans feel towards the land, water, and animals that sustain them. Although he does not mention the word itself, one rancher captured the essence of querencia as he told me “what Northern New Mexico is all about”: 
We were raised to be respectful to mother earth. Very respectful…that’s in summary how sacred the land and the water is in how we were raised and how we were brought up. And that’s the reason we’re so protective, Sonja, for the land and the water."

Considering the momentous demographic and economic changes and influx of commercial interests taking place in Taos County (such as the development of private swimming pools), it is understandable that local communities are concerned for the protection of both their physical environment and their ideologies.

A Valley of Sheep

I sat across from Carlos at a Chinese food restaurant. We had just finished switching soups with one another after he realized that the soup he ordered was not the one he intended to get. “Say it again,” Carlos instructed me. I had just managed to mispronounce the name of Carlos’ grandfather, Juan de Dios, once one of the largest sheepherders and property owners of northern New Mexico. Embarrassed, I repeated his name making sure to clearly pronounce each syllable. “That’s better,” he said. This was not the first time I had encountered the name. I had seen “Juan de Dios” printed in little white letters on one of the street signs leading up to the road to my parents’ property in Arroyo Seco, but had never paid it much attention before. Now, I found myself sitting across from Juan de Dios’ grandson, eating hot and sour soup. Carlos wore a beautiful black cowboy hat, jeans, and cowboy boots. I was referred to him by a journalist from The Taos News, who told me Carlos was the person to speak to about the history of ranching in Taos and changes over the years in response to politics and other pressures.

Carlos is an example of the generational depth and cultural heritage of ranching found in Taos County. He is a proud descendent of one of the original Spanish settler families that arrived in northern New Mexico during the early Spanish Colonial period in the 1600s. Carlos
was born and raised in Taos and is the only one of his siblings to carry on his family’s 400-year tradition of ranching in northern New Mexico. He undoubtedly takes the continuation of Juan de Dios’ legacy very seriously and keeps the same animals that he was raised with growing up. Yet, Carlos is also a former court judge, a Vietnam War veteran, and is now the grandfather of several grandchildren. He owns a bail bonds firm in town, and is seemingly involved with all water and land-related issues in Taos County.

Upon settling in northern New Mexico, Carlos’ family ancestors were issued a large land grant from the King of Spain, which was passed down generationally, eventually landing in the hands of Juan de Dios. Land grants were a method used by the Spanish, and later, the Mexican government, to promote settlement of the New Mexican territory, or Territorio de Nuevo Mexico. Grants were issued at both the individual and communal levels, establishing residential and ranching settlements.

Carlos described how his ancestors came to be in charge of a Spanish land grant:

The king of Spain gave land grants to people who were of Spanish descent. They were all blond and blue-eyed. That’s how my family was, very light complected. You had to have that gene to qualify for those land grants. That’s how my great, great grandfather came in having ownership of 60,000 acres…Through my mom’s side there were fifteen kids, two died, all descendants through Spanish blood. They controlled Arroyo Seco.  

Within land grant settlements, particularly the communal grants, people established little villages whose farmers and ranchers could treat the land grant’s grazing pastures and timberlands as common lands. A communal system of collaborative grazing and farming practices emerged in which settlers were able to survive in relatively small and isolated plots of land in what was, at times, a severe climate. The surrounding high mountain pastures and forests of the Taos area were vitally important to the survival of ranchers’ livestock, providing fertile grazing grounds that ranchers could access communally throughout the year, especially when the lower elevations
of Taos Valley experienced drought. As described by McSweeny and Raish, “community stocks were individually owned but cooperatively grazed.” Livestock did the work of plowing, threshing, transportation, and fertilizing lands. They were herded to mountain pastures in the spring and summer, and brought back to the village lands in the fall to fertilize and graze upon the harvested fields.

Carlos’ ancestors are examples of some of the settlers who practiced this kind of subsistence-level ranching in the Taos area. He remembered that:

My great grandparents had sheep and they used to graze them up at [what is now] the ski valley, and livestock, cows as well. Having so many kids, they were the laborers. [They] had kids to sustain the operation. Juan de Dios was probably the biggest sheepherder of northern New Mexico at one time. He used to own a bunch of acreage all around the ski valley and Arroyo Seco. So I still have sheep today. I have cows. I have horses. I have everything that I was raised with.

While most early ranchers kept a combination of sheep, cattle, and horses, sheep were dominant in New Mexico, differentiating the territory from Texas and California, where cattle comprised the majority of livestock. As one rancher stated, “this valley was nothing but sheep.” It is not entirely clear why sheep were emphasized in New Mexico as opposed to cattle; however, one possible reason why sheep proliferated in northern New Mexico during the Spanish Colonial period is that under Spanish law, every livestock animal that wandered into farmland or acequia ditches was punishable for a fine of two reales. Since sheep require constant supervision by a sheepherder, sheep would have been prevented from trespassing on farmland. Cattle, in contrast, roamed unsupervised for weeks at a time until their owner rounded them up to sell or slaughter, making them more likely to graze in prohibited areas. Additionally, given that Indians surrounded most sides of the New Mexico territory, having supervised sheep herds would have also reduced the number of animals lost to ranchers in raids.
The sheep to cattle ratio fluctuated over the Colonial period in New Mexico. A provincial livestock census from 1779 indicates 69,366 sheep and 7,676 cattle, a ten to one ratio.\footnote{56} During Mexican occupation (1821-1848), the wool market expanded across the Southwest and sheep numbers in New Mexico continued to increase, reaching 240,000 head by 1827.\footnote{57} In contrast, cattle numbers declined to 5,000.

Ranchers’ descriptions of their ancestors confirm the importance that sheep had in Taos. Richard, a rancher with deep roots in Taos, explained his ancestors’ sheepherding practices, which included multiple-week long cattle drives across the territory:

Ever since the 1800s, the settlers came in and my great, great grandparents lived in Arroyo Seco in a puebla, like a fort for protection from whatever Indians were there. They started farming and ranching then, and never gave up. [My grandfather] used to graze sheep, probably around 3,500 sheep, in Arroyo Seco. He owned a lot of property in Arroyo Seco and Tres Piedras and he’d walk them all the way to Chama [a town just south of the Colorado border]…They used to walk the sheep from here and it would take weeks. That was before there were fences and all that, of course.\footnote{58}

At that time, ranching was a full-time occupation. As one rancher told me:

Years ago, they used to make a living out of [ranching], they had to, to survive…going into the town of Taos was like going to Santa Fe now; they only used to do it for getting sugar, coffee, you know, the bare essentials. Everything else they grew themselves in gardens and sheep or whatever else.\footnote{59}

Many of the ranchers that I spoke to emphasized how early ranchers had skill, knowledge, and deep relationships with the animals and land that enabled them to survive in northern New Mexico. According to Carlos, Hispanic ranchers were, and remain, “the best stewards of the land there is.”\footnote{60} The concept of querencia, a sense of place, relates to land stewardship. As noted earlier, querencia extends beyond the human realm—animals too, have their own sense of place. In the same way that humans become acclimated to their environment, northern New Mexican ranchers believe that their livestock have a sense of where they are
supposed to be as well. Early ranchers of northern New Mexico used to release their livestock into the mountain forests, following them to locations that the livestock chose. An interviewee in McSweeny and Raish noted that, “Years back, there were no fences. The cattle went up and came back down on their own; they had their querencias.” Another interviewee captured the concept of querencia when applied to livestock:

Management cannot be mechanical and superimposed on cattle…because cattle, being closer to nature than humans, know better where to graze, how to graze, how to congregate…So obviously, they select areas where they move to during the day, at night, and different months as the season changes. They have a heightened sense of awareness of how to co-exist with the grasses, the forest, and the elements. Cattle know if they are feeling ill and know the kinds of herbs with which to treat themselves… Animals have a brain too! They have intelligence and know better how to survive. We are not a cow!

The open forests and mountain pasturelands allowed livestock to seek out water and hidden pastureland, essentially preventing the overgrazing of one particular area without the need for human intervention in the form of fences. Part of honoring querencia is acknowledging that animals have a bank of knowledge about their environment acquired over the years. Many ranchers believe that when livestock are given the opportunity to find their querencia, the herd is able to pass on information about their environment to the younger animals. For example, young cattle learn from the mother cows about how and where to graze, making the herd increasingly more knowledgeable about their environment over time. The expertise of a well-acclimated herd allows ranchers to learn grazing practices from their animals, as opposed to the other way around.

The Loss of Communal Lands

Continuing our conversation about land grants, I sat across from Carlos in his office where he handles bail bonds. “Everything changed with the loss of the land grants,” he said.
After hearing about the storybook-like origins of ranching in northern New Mexico, with people and animals living in harmony with one another off of the land, I was now about to learn how the lives of ranchers changed in Taos, and how Carlos’ family lost nearly all of their land with the transfer of the New Mexican territory to the United States:

After New Mexico became part of the U.S., things were very different. After the Treaty of Guadalupe Hidalgo, the U.S. government came in and they took land, and then the federal government gave [the Indians] their share…now we have 2,000 acres left [of 60,000 acres] where you’re staying up in Pawasuki [Arroyo Seco]… so that’s why we fight so much for what’s left…and that’s why I fight to keep Juan de Dios’ memory alive.  

After the United States fought Mexico in the Mexican-American War of 1846 for control of what is now the Southwestern United States, land ownership and use patterns changed dramatically in New Mexico. The Treaty of Guadalupe Hidalgo was the peace treaty signed between the U.S. and Mexico in 1848, ending the war, and establishing the U.S. as the new landowner of the New Mexican territory. Part of the treaty was intended to protect the property rights of former Mexican landowners during the land transfer. However, there were many stipulations put in place that sabotaged this protection, resulting in the loss of the majority of Hispanic lands, including those in Carlos’ family.

In an effort to protect their land, Hispanic landowners faced a number of obstacles. First, Hispanic land owners’ property rights were not valid in the U.S. until they appealed to both the Surveyor General to the Congress, and after 1891, to the Court of Private Land Claims. The Court of Private Land Claims was created by President William Henry Harrison to “adjust” Spanish and Mexican land grants, which were viewed as having a negative impact on the property values of Anglo settlers. In his State of the Union address, President Harrison said:

The unsettled state of the titles to large bodies of lands in the Territories of New Mexico and Arizona has greatly retarded the development of those Territories. Provision should
be made by law for the prompt trial and final adjustment before a judicial tribunal or commission, of all claims based upon Mexican grants. It is not just to an intelligent and enterprising people that their peace should be disturbed and their prosperity retarded by these old contentions…These disputes retard the prosperity and disturb the peace of large and important communities.66

To complete an appeal to the Surveyor General to the Congress and the Court of Private Land Claims, landowners had to hire an attorney, file an official claim, and collect all required documents. The legal expenses accrued in this procedure were often equivalent to one-third to one-half of the value of the land involved. As a result, most landholders sold a portion of their land, ironically, for money to apply to keep as much of their property as they could. Even when landowners did file a claim, the Surveyor General and the Court of Private Land Claims had the right to reject claims for a variety of reasons, resulting in only 24 percent of land claims in New Mexico being recognized by the U.S. government, compared to the 73 percent of claims recognized in California. Additionally, land was lost due to the fact that Hispanic landowners simply could not afford to pay property taxes on their land under the American tax system.

One of the most devastating aspects of the treaty was that the Surveyor General and the court did not honor communal land grants, such as the common pastures and forests that provided northern New Mexican Hispanic ranchers with grazing land and firewood for decades. Communal land ownership conflicted with the United States’ legal emphasis on private land ownership. Much of the communal land became part of “the public domain,” and eventually would become the Carson National Forest (CNF).67 In Taos County alone, the Carson National Forest acquired entire or large majorities of individual and communal land grants, so that confirmed Spanish and Mexican land grants now comprise approximately twenty-two percent of the forest’s 1.5 million acres, “with additional land coming from claimed but unconfirmed grants.”68 Francisco, a local high school biology teacher and agriculturalist who conducted his
master’s thesis on the decline of farming in Taos, stated: “Full-time ranching and farming came to an end in Taos with the loss of communal lands. It all comes down to that.”

After the land was taken from Hispanic communities, political corruption ensued and much of the land was stripped of resources by large timbering operations, such as the Santa Fe Ring, a group of powerful attorneys and land speculators who then sold it to the U.S. Forest Service and Bureau of Land Management, which manage it today.

Francisco explained what happened after the Hispanic land grants were lost:

I’ll tell you right now, first the land grants were taken from the people, then the railroad came. Those things happened simultaneously. The land grants were taken to get the logs to build the railroad ties for the second railroad across the United States.

The Santa Fe Ring used the United States property laws, and the United States tax laws, and took over the land grants, which were communally owned properties. And they logged them. And the way they logged them is they made flumes [man-made water channels]. They took the streams out and put them in flumes, and they started milling them up in the upper watersheds, bringing those logs down the flumes, and putting them in the rivers. And then they would dam the rivers, and they would fill that dam up with railroad ties, and then they would dynamite the dam, and the railroad ties would go down stream, and they would pick ‘em up in Albuquerque to build the railroad. So simultaneously, they stole the land, cut down the trees, impaired the upper streams, impaired the rivers, and then they turned around and sold all the lands after they raped it, sold it to the federal government for 12 cents an acre, and now they’re public lands: Forest Service and the BLM.

I was able to see the scars of some of these operations myself as I accompanied a land conservation team up into the Taos Canyon to do fire-hazard reduction work. Along the steep slope of the forest, every twenty feet or so lay a vertical rift, leading down to the road. As Martin, the head of the conservation crew, pointed out to me, “you can see where timbering folks used to slide logs down the mountain side, probably with horses, which would have been the most practical thing to do at the time. But those are the scars of that, and now they act like arteries out of the forest in which water and snow runoff will hemorrhage, instead of settling in
the forest floor to be absorbed by the trees.”

In a short period of time, land that was freely accessible to ranchers became federal land that was only accessible by permit. Beginning in the 1920s and continuing through the 20th century, the Forest Service focused on the issue of overgrazing. One of the ways the Forest Service addressed land conditions was by initiating a series of top-down range improvement programs that entailed unprecedented limits on grazing activity in the forests. In 1925, the Forest Service began authorizing 10-year grazing permits in national forests, “furthering private sector profit on national public lands.” After applying for a grazing permit, ranchers would receive a grazing allotment with a specific plot of land on which they could temporarily graze their cattle. This permit-based grazing system undermined the traditional querencia grazing system practiced by Hispanic ranchers, preventing livestock from being able to fully explore and become accustomed to their environment. Instead of being able to follow livestock to their preferred grazing location, ranchers now had to physically transport and lead their herds to a specific, oftentimes fenced, grazing allotment.

Despite the challenges presented by the loss of communal grazing lands, the high demand for meat and wool during World War I and World War II kept many Taos County sheepherders in business through the 1940s. However, after World War II ended, prices for livestock and wool plummeted. One rancher commented that, “You gradually got the influx of all these other kind of fabrics, synthetics and all that, and wool wasn’t barely worth anything anymore.” Beginning in the 1950s, the Forest Service also enforced special restrictions on the number of sheep and goats permitted in the Carson National Forest. Many permit-holders were told by the Forest Service that they could no longer herd both sheep and cows and that they would need to choose between the two.
Carlos explained to me that even though his ancestors always successfully grazed sheep and cattle together, ranchers had no choice but to change their practices, many of them choosing to give up sheep herding:

Juan de Dios used to graze up at the ski valley, both sheep and cattle, and they were compatible. And then after New Mexico became a state, the government came in and said you can have one or the other, you can’t have both because they said there was not enough grazing to sustain them. I’ve seen pictures of when they had both, and I was a small kid, and they were grazing side-by-side. But they started cutting them down and [ranchers] didn’t have the means to defend themselves—Very passive people, not a form of education. But they knew business. So they sold the sheep and then they grazed cattle until they died.  

Low prices for animal products combined with stringent reductions in the number and type of livestock permitted in the Carson National Forest from the 1950s gave many ranchers no choice but to reduce their livestock herds, some by much as sixty percent. By 1980, limited sheep and no goats were allowed to graze in the Carson National Forest, and the number of grazing permits for other kinds of livestock continued to decline as well. The restrictions on grazing lands, low meat prices, and herd reductions made it increasingly difficult for Hispanic ranchers to maintain a subsistence-based living, pushing many into wage-work.

Many of the U.S. Forest Service initiatives were seen by local ranchers as invasive, punitive, and misinformed. The U.S. Forest Service maintains control over grazing in the Carson National Forest today, and many ranchers’ feelings towards the agency have not changed.

Leroy, who has been ranching in Taos County since he was a little boy and who spent thirty-one years working with the Forest Service, explained to me how land management interventions by government agencies have mostly failed, and have marginalized small-scale
ranchers in the process:

You’re getting people here that don’t understand the forest saying that they’re overgrazing the land. In fact, we get a lot of forest fires because the day they took the sheep out…the noxious weeds and everything else also came back…Imagine if a sheep can browse up to the trees here and everything else, and from there, kind of keep it cleaner. It helped with the fires.

And then another thing about having a healthy forest is a forest that has maybe a hundred and fifty, a hundred and eighty trees per acre. Now you’ve got three, four, five hundred trees per acre. It’s so dense there’s a not even animal in some places. They stopped the timber industry…the forest service doesn’t have a timber industry anymore. Clinton shut that down in ’91, ’92. Its just groups that are in Washington, in government, that lean to the extremist environmentalism. We’re all environmentalists, I mean, but these people are extremists, and they won’t meet you in the middle. It’s our way or nothing. There’s no, there’s no mediation, and that’s what’s hurt the land and everything else. And that’s part of the cycle that we’re having. So, the government has a lot of blame in it, the Forest Service, the management. They take these people that come out from other areas, and they try to change everything by the book instead of what’s in the ground. And they don’t respect the cultures. Instead of seeing how we would work, how it has worked in the past, how is it that we can improve it, they’re just shutting it down and saying no, it’s just this way.\footnote{82}

Since Leroy had been a former long-time employee of the U.S. Forest Service, his words are particularly telling of the dire state of land management in Taos County, especially regarding ranching.

Martin, the land conservationist whose fire hazard reduction crew I shadowed, also spoke about how forest management policies have resulted in an unhealthy Carson National Forest. He stated that:

The Rocky Mountains in general suffer from overcrowded forest. Here in Taos, some parts of the forests are so dense, that winter snowfall isn’t even reaching the forest floor. Then, when you have a warm climate on top of that, most of it is just lost to evaporation before ever reaching tree roots. That leads to a very unhealthy watershed, which of course ends up hurting the \textit{acequias} down below.\footnote{83}

The extensive logging that took place in National Forests in the early part of the 20\textsuperscript{th} century triggered a concern by environmentalists regarding over-logging and the timber industry’s impact on endangered species (such as the Spotted Owl). In response, the Clinton administration
banned road building and logging in vast areas of National Forests across the county.\textsuperscript{84}

However, as discussed by a speaker from the Forest Service at the New Mexico Stockmen’s Association meeting:

We originally thought that the timbering industry was the main threat to endangered species like the Spotted Owl. However, after the timber industry stopped and we’re starting to see really dense forests and more and more unprecedented high-heat, crown fires in our forests, people started to realize that these kinds of fires present more of a threat to endangered species than does logging. And the reason for those high-heat, intense fires is an overly-crowded forest. So we’ve got a lot of work to do in New Mexico in terms of forest thinning.\textsuperscript{85}

Having seen land management policies evolve in Taos County over the years, Carlos also viewed the Forest Service land management as top-down, misinformed, and devastating to both the land and the ranchers of Taos County:

The Forest Service tried to void the [grazing permits] … Rangers that come in, people that are incompetent, they come in with a badge in forestry and they say ‘[Carlos], blah, blah, blah, I want to withdraw your permits’…We have to go through the congressional delegation to tell [the Forest Service] to get rid of these folks…they have no sensitivity. At least be respectful, I says, be respectful…You’ve never had your boots on the ground, and now you’re coming and telling me what to do. So, I wrote to the regional forester and then they finally said, ‘can we sit down and have mediation?’ We went though mediation like a school with a supervisor and a mediator.\textsuperscript{86}

Carlos said the Forest Service Ranger mandated that, according to the Forest Service Annual Operating Instructions, he cut his grazing area in the forest by fifteen percent and move his cattle to an area where there was “no food, very little water.” When Carlos refused to do so, the Forest Ranger threatened to revoke his permits altogether and impound his cattle, resulting in a lawsuit between Carlos and the Forest Service that is still in process today.

In response to my question about the reasons behind Forest Service permit restrictions, Carlos responded:

It’s outside pressure from environmentalists, people who have no knowledge of northern New Mexico. There was a lot of grazing that existed before New Mexico became a state,
and there’s, you know, forest guardians, environmentalists, then there are the people affiliated with NIPA, with the environmental studies and so on so forth and they’re the ones who give us a hard time… environmentalists came in and said this place is overgrazed and so on so forth and never did an environmental study… they use drought as a factor … the USDA, the Forest Service just wanted some form of negative document to be able to say [stop]. That’s pretty much exploitation, you know? They don’t know that we are probably the best guardians, the best stewards of the land there is.87

In fact, a study by attorney Mike Scarborough found that:

Studies requested and paid for by the Forest Service made it clear that increases in forest fires have always been during times when there was less grazing. Even though the Forest Service bought and paid for those reports that prove grazing reduces the number of forest fires and even though the number of forest fires keep increasing, the Forest Service continues to ignore the information and continues to reduce grazing.88

Ranchers shared that the government and environmentalists use the word “drought” and “overgrazing” as trigger words to influence land management policies. One farmer that I spoke with explained that the word “drought” has taken on political connotations due to its frequent use in top-down political and environmental initiatives. He said that he prefers the word “water stress,” which is less politically charged.89

Ranchers also shared similar sentiments with regards to government agencies and environmental groups not taking longtime Hispanic ranchers seriously as land stewards. Despite their 400-year experience with the land and animals in Taos, one rancher described how agencies like the Forest Service overlook the local decisions and actions taken by ranchers to protect their land:

It’s like the Forest Service doesn’t trust ranchers to do the right thing, but they don’t realize that a lot of times, we’re the ones who self-elect to do what’s best for the land. Like this past summer, when everyone was cutting back their cattle stocks in the drought, much of that was self-elected. Ranchers knew that it wasn’t economically or environmentally feasible to keep their numbers high.90

Martin, the soil and water conservationist, also shared his dedication to and respect for the land
as a rancher:

People ask how ranchers and farming are responding to the drought, but weather is just one factor. People forget about the land and how we treat the land. When ranchers graze their cattle on the land for extended amounts of time and the cattle eat all of what is on it, then the land is left very exposed. When you have a lot of rain it can be okay, but when you have a bad drought like we did this past year, it literally bakes and kills the soil and you lose that protection of the top mantle. The rains in July helped replenish some of the grasses but when you have prolonged drought you need a protective covering on the land. You never want bare soil.

If there were to be a two-year drought with no water, which we haven’t experienced yet, if my cattle were in danger of ruining the land, I would sell my cattle. The land is the most important part and I would sell my cattle before I let anything happen to the land.91

In addition to being overlooked as stewards of the land, Hispanic ranchers also expressed a disappointment that their historical contributions to the land are generally unrecognized on a historical and political level. For example, Leroy, who is also a commissioner of the Finado Francisco Martinez acequia said:

A lot of people don’t recognize that the acequia associations are actually the oldest form of government there is in this country. The management and governance that goes into running an acequia, it’s collaboration and reciprocity. There’s four ditches in Taos that have been running since before 1776 when the United States became a country. But the history books don’t teach that…I’ll give you a copy of our bylaws and you can see how formal it is.92

In response to historical amnesia and the challenges presented to ranchers by the Forest Service and other groups, Carlos is one rancher in Taos County who has made it his mission to protect his family’s traditions and past, and to advocate on behalf of Hispanic rancher like himself:

[The Forest Service] has reduced the permits, simply because people don’t defend themselves. They were people who were too passive. And the kids, the younger generation, don’t want to pick up anything. So like me, see my grandmother taught me to fight, fight, fight, so that’s the reason why I still stand my ground in a civilized
fashion…I’m probably the only one who can graze in three different allotments in Northern New Mexico [because of that].

Juan de Dios is a saint. I’m a devil and he was a saint because I do a lot of fighting and all kinds of stuff, which is okay. You fight for what you feel is social justice.\(^{93}\)

While most ranchers today in Taos County maintain grazing permits on the Carson National Forest today, those who are descendants of land grantees, like Carlos, clearly feel aggrieved at having to pay the government to access land that is part of their cultural and ancestral heritage. It is not surprising that many ranchers and scholars argue that the Treaty of Guadalupe Hidalgo was effectively never implemented in that it failed to protect those that it was intended to protect, namely the property rights of former Mexican citizens.\(^{94}\) Meyer asserts that not only were Hispanic people’s access to land and water violated by the U.S. government, but that the livelihoods of rural Hispanic communities that depended on these precious resources were violated as well. Additionally, because the grazing restrictions put in place by the Forest Service are ill-suited to the needs of small-scale ranchers, there has been a decrease in the number of overall permit-holders. At the same time, mostly non-Hispanic ranchers are consolidating land permits and increasing the size of their livestock herds.\(^{95}\) For many of the Hispanic ranchers, the Forest Service has proven favorable to large-scale ranching, and ignorant and insensitive to the Hispanic traditions and culture of the region.

Although there have been initiatives to revaluate the property rights in the original treaty, none of them have resulted in substantive reform as far as northern New Mexican land grant heirs and activists are concerned. As stated by Shadow and Rodriguez-Shadow, “land grants continue to serve as charters of local identity, reminders of historical injustices, and potent symbols and catalysts of ethnic mobilization for those descendants of the original settlers who remain attached to the land and committed to preserving this tradition.”\(^{96}\)
When I pulled up to the gate, I thought I must be in the wrong place. Sagebrush was the
only living thing inhabiting the land for as far as I could see. I checked the mile marker again.
This was it. I hesitantly continued up the dirt road and was relieved to finally cross a cattle guard
and see lamas feeding in the distance. This was the ranch after all. The landscape was severe,
miles upon miles of exposed dirt, sprinkled with snow and shrubs. I began to wonder how any
animals could survive out here. I was on my way to meet Frank on his 4,000-acre ranch in Tres
Piedras, an area west of the Rio Grande set on the Taos Plateau. Frank is a retired geologist who
serves on the board of the Taos Soil and Water Conservation District and ranches as a hobby.
My purpose for the visit was to get a first-hand account of the impact that the harsh 2012-2013
drought had on ranchers, especially those with grazing land west of the Rio Grande, which lacks
access to the acequia irrigation of the eastern side of the county.

I finally spotted Frank’s red pick up truck and pulled up to meet him. Frank was
accompanied by Sarah and Daniel, friends who help out on the ranch as well. Daniel had just
come back from elk hunting and was wearing camouflage pants and a cowboy hat. After I
introduced my research project and myself to the group, Frank told me that, “For the past three
years, we’ve gotten four inches of precipitation annually. We’re supposed to get eight inches
annually but we’ve only gotten half. In 2000 we got nothing, almost no rain at all.” Gazing out
upon his land, Frank told me that most of the native grasses died in the 2013 drought, a
continuation of the extremely dry conditions of 2012. Unlike pastures on the eastern side of the
county that have access to irrigation via acequias, the vegetation on Frank’s land is completely
dependent on rainfall. In this kind of dry land ranching, every inch of precipitation that falls
counts, and every inch of grass that grows counts. Frank explained, “This year, we got 24 inches
after July 5, but before that, nothing.” The 24 inches was due in part to the week of September 10, 2013, in which areas of New Mexico and Colorado experienced excessive rain, culminating in the historic 100-year flood for Colorado, and bringing up to 10 inches of rain to New Mexico. Commenting on the post-July rains, Frank said, “It helped some of the grasses grow back, but for the most part, it was too late. It was just too dry…most of the rain just ran off the land because the top soil has been blown off, so the water just floods down toward the west.” The only bit of native grass left growing on Frank’s land is blue grama, growing an inch or two high, with the rest of the landscape dominated by sagebrush, a drought resilient shrub that is largely inedible by livestock. Frank commented, “Sagebrush doesn’t let native grasslands grow because it sucks up all the water. We’ve plowed most of the sagebrush off the grazing land, and we’re trying to restore a lot of the grassland…I planted some winter grasses down on the west side of the land and they have done pretty good; they’re more resilient to drought.”

Traditionally, ranchers bring their cattle up to feed on the grazing allotments in the high country of the Carson National Forest when the forage on their own pastures is scarce. Due to the high desert environment of the Taos region, the mountain forests provide much-needed lush pastureland for ranchers, especially in times of drought. For ranchers who do not have access to irrigated pastures in Taos Valley, such as Frank, forest grazing is even more critical. However, in response to the dry conditions of 2013, the Forest Service decided to delay summer access to the grazing allotments in the Carson National Forest, putting ranchers in a difficult position. For Frank, the combination of not being able to access the mountain pastures and the death of native grasses on his own land left him no choice but to sell off two-thirds of his cattle during the 2013 summer, reducing his stock from 90 to 30 head of cattle. “It was just too expensive,” he said.
Additionally, while Frank’s land used to produce enough native grasses for him to purchase hay or alfalfa for his livestock only in the winter, the demise of native grasses has forced him to feed his animals year-round with purchased feed for the past three years. This may have been a financially feasible endeavor in the past, when hay prices were low; however, hay prices have more than tripled over the years due to the hardship of the drought. Daniel remarked that, “You used to be able to buy hay for three dollars a bale, and now it is about ten to eleven dollars per bale...that combined with costs for fencing, diesel, and everything else makes ranching really expensive these days. That’s why water is more valuable than oil. Water is life.”

I asked Frank if he had experienced other changes in the landscape over the year in Tres Piedras. “We used to have a lot of piñon trees, but the bark beetle got most of them. We’ve been trying to take care of the dead ones since then and clear them out. And now we get dust storms. One of them came all the way from Questa [north of Taos] to here. I’ve never seen it that bad before.” Frank observed that the bark beetle thrives when there is drought because the piñon trees do not produce as much sap as they normally are able to, allowing the beetle to penetrate the bark and weaken the tree with pathogens. He also described the process of “pedestaling” in which the wind blows topsoil off the land except for the soil secured in the roots of sagebrush and larger plants. Frank kicked the ground: “Then when it rains, like it did in September, it all just washes away and you get erosion. See how the soil is uneven?” According to Daniel, they had deliberately covered some of the exposed soil with hay because “the worst thing you can have is bare dirt.” Indeed, Frank and Daniel attributed dust storms to the low density of native grasses in the area, especially on the property bordering Frank’s land, which belongs to the Bureau of Land Management (BLM).
Daniel described a fire that occurred in 2010 on the BLM land that threatened Frank’s property:

The Bureau of Land Management doesn’t allow any plowing to be done of land without an archaeological survey, which is really expensive, so all the land bordering this land is all sagebrush because it is owned by BLM. Three years ago a fire started and went through BLM land, burned down the fence bordering [Frank’s] land, and got onto our property. But no one can touch the BLM land. The land between sagebrush is just dirt, there’s nothing covering the land so it lends itself to dust bowls and fires. Grasslands would reduce the fire risk and would make the land into usable grazing land, but no one can touch it.101

I concluded my visit by asking Frank what he sees as the future of ranching in Taos County. He replied, “Well, there are barely any full-time ranchers in Taos. And if you look at the average age of ranchers, it’s in the sixties…and some people have already sold off all their cattle, it’s just too expensive.” Frank’s friend, Sarah, who lives in Arroyo Seco gave her opinion: “It is really tough to ranch through drought, and if the drought continues, well, I guess people stop ranching.”102

The threats posed to Frank’s ranch embody the challenges faced by most ranchers in Taos County in the current dry conditions: severe water stress, reduced grass and hay yields, fire hazard, restricted grazing allotments in the Carson National Forest, and high costs for feed (although this is a benefit for those who grow and sell their own hay or alfalfa). Given the duration people have been ranching in the region of Taos County and across New Mexico, these climatological challenges have been encountered and overcome by ranchers in the past. For example, the New Mexico Historical Review of January 1944 writes about the drought conditions New Mexican ranchers endured in 1917: “Drought, which was ever a portentous factor in New Mexico’s wartime food problems, affected another of the state’s vital enterprises—stock raising. It is true that, in spite of the weather, livestock increased in 1917; mules, horses, hogs, and cattle
all were more numerous.” Enrique, a descendent of a long line of Spanish ranchers in northern New Mexico, reinforces this idea of ranchers’ resiliency to drought. He explained, “We as ranchers have always adapted alongside drought and changes in climate. When the environment changes, we change, and that’s how we get by.”

*Ranching and Climate Change*

Hispanic agricultural practices, such as the use of *acequias*, have been resilient to climate fluctuations in history and in studies. In her study of *acequia* resilience, Miller writes that, “*acequias* and *acequia* systems in Taos were found to be robust to drought.” Yet she goes on to say that, “Although [*acequias*] have been shown to be robust to drought and climate change in the past, [climate projections] suggest that droughts may be more severe in the 21st century than they were in the 20th century, and that additional safeguards need to be put into place to protect *acequia* systems.”

Indeed, climatological literature indicates that the kinds of climate variations seen in northern New Mexico today are unprecedented. Climate conditions are rapidly changing in response to rising global temperatures. Sean, a journalist from *The Taos News*, told me, “I think what’s really got ranchers shaking in their boots now is the idea that this might be a drought that doesn’t have a close end in sight, and I think they’re starting to realize that.” According to the latest report by the Intergovernmental Panel on Climate Change (IPCC), “each of the last three decades has been successively warmer at the Earth’s surface than any preceding decade since 1850. In the Northern Hemisphere, 1983-2012 was likely the warmest 30-year period of the last 1,400 years.” Jonathon Overpeck, a contributor to multiple IPCC assessments, says that, “[The Southwest] can get about 50 percent more warming than the IPCC thought in this part of the
world, and that means the snow and runoff impacts will be substantially larger than anyone else is suggesting".\textsuperscript{109} Since 1960, New Mexico in particular has experienced an increase of 2 °F in the warm season and about 3 °F in the cold season.\textsuperscript{110} This is twice the global trend, which averaged an increase of 1 °F over the 20\textsuperscript{th} century.\textsuperscript{111} The warming of New Mexico has and will continue to put stress on water supplies in the state by increasing the evaporative loss from summer and winter precipitation, as well as from streams and soil.\textsuperscript{112} A warming climate is also associated with more extreme weather events, including severe drought, and ironically, floods.

Numerous reports, including those most recently produced by the IPCC, indicate that winter precipitation is likely to severely diminish over the 21\textsuperscript{st} century across the Southwestern United States, including New Mexico.\textsuperscript{113} The result of decreased winter precipitation (coupled with a warming climate) in New Mexico includes reduced snowpack, earlier spring melting, and an increasing snowline elevation.\textsuperscript{114} Perhaps most significant is a report from the State Engineer’s Office that includes a climate projection indicating that there may be no snowpack north of Santa Fe by the end of the 21\textsuperscript{st} century.\textsuperscript{115} This is a particularly ominous projection, as snowpack in Northern New Mexico is critical for the health of the state’s reservoirs, streams, and acequias, as well the people, animals, and plants that depend on them for survival.

Based on information gathered in the interviews, local ranchers are already witnessing symptoms of reduced snowpack and changing seasonality in Taos County. Emilio, who comes from a Hispanic ranching family and who grew up in Arroyo Seco, said the last big snowfall he saw in Taos was during the winter of 1987. He described the winters that he remembers growing up with:

Before they made the big snowplows like they have now, we used to get two big planks of wood and mount them on the front of our truck in an upside-down V-shape to plow the snow away from the driveway before we could get to the house. Now, I plow for the neighborhood as a second job and I bought my snowplow on a short-term loan with a
balloon payment. But then it stopped snowing season after season and no one really needed their driveways plowed. And in there, one of those same years, my son was badly assaulted. Then on top of it I had this balloon payment that I had to pay off. It really hurt. I’ll never take out a loan like that again.\textsuperscript{116}

Emilio went on to describe how the condition of his land in Arroyo Seco had changed in response to dry conditions: “I used to be able to dig down about half a foot and hit water. Now, the other week I was working on putting in a new fence for my dog and the ground is so hard that I can barely even dig down. I had to soak the ground over night to be able to dig a hole.”

Daniel, Frank’s friend, also reminisced about the old snowfalls in Taos:

\begin{quote}
I used to work at the ski area with my brother under Ernie Blake [the founder of Taos Ski Valley] when we were kids. I used to pick up trash on the ski area and down the road and in return we would get a ski pass for $10 a year. And then I joined the Air Force for four years and when I got back I was given a job again. We used to see snows 2-3 feet easy. We would get snow on Halloween, at least a couple feet, and now we barely get snow on Christmas. My dad used to help Ernie Blake cut the ski area. He told us he hoped that we would get to see the big snowfalls that they had back in the day sometime in our lifetime. The last big snow I saw was probably like 1987 or 1988. We haven’t had anything like that since.\textsuperscript{117}
\end{quote}

Leroy, the retired U.S. Forest Service employee whose ancestors began herding sheep in the Taos area in the early 1800s, provides an additional account of changing climate. He recounted his memories and observations of the weather patterns:

\begin{quote}
I’ve seen the changes in the pattern of drought and all that stuff... We used to walk up to the other side of Llano Quemado [a town southwest of Taos] to the old county schools, and at that time you’d see these snow drifts and the county, they wouldn’t sweep the snows... I remember as a kid walking up the snow banks and they were hard. But it always seemed that it always rained more and it always snowed more. Sometimes you look at the old records and it doesn’t show that much [of a difference], and I used to argue with my dad, we used to talk about that. But the droughts have really taken a toll in a lot of farmers and ranchers, and the water especially. This drought that we’re in now, I saw it coming in 1989 [because] there was less snow pack.\textsuperscript{118}
\end{quote}

Leroy went on to describe how he has seen summer precipitation patterns change in northern New Mexico, too:
We used to herd our sheep up in the Pecos, what is now the Pecos Wilderness… I was there 1956 through ‘67, ‘68. So every summer, what it consisted of is staying up there with the sheep, herding sheep all summer at 12,000-foot elevation. And during those times, I remember, with the rains, we were always wet. And then the grass was really high, so in the mornings, you were always wet with the dew. It would rain so much that we were always covered. But you don’t see it as much with the rains now… The monsoons used to come in early, the first of July or whatever, and they used to stay and just rain and rain and rain. But you don’t see that anymore.

Snowfall and summer precipitation have a significant impact on ranchers. When there is a healthy snowpack in the mountains that slowly melts throughout the spring, there is a steady supply of water feeding the acequias throughout the summer months until the monsoon rains begin. Alternatively, when there is a meager winter snowpack, combined with warm winter and spring temperatures, the snow that does exist melts quickly and the rate of evaporation increases, resulting in early-season water stress. This trend accelerates when the start of the summer monsoon season is delayed.

Leroy continued his account of how the climate patterns over the past couple of decades have worsened, culminating in the especially hard 2012-2013 year that caused him to cut his cattle stock by almost half:

From 1996, we had a little more snow, so what [ranchers] planted came up and then the next year, it was a little less. But there was always still a runoff. We used to irrigate all summer long. You’d be able to get through two cuts of hay in this area [in the summer], and then it went down to about one and half, and then it started to where [it got worse]… But you still had at least a little bit of runoff. And then in ‘02 [2002], I thought we hit bottom. ‘02 was really, really bad…I said well, I don’t think we can see another one like this. And then this year [2012-2013] we got this one. We didn’t have a single drop of runoff. And we depend on runoff. It snowed, but last summer, we had very, very little rain, come fall nothing. So the first snows that we got last year in December, you would get snow, but it was so dry that when you would sweep it, underneath the dirt was dry as could be. Dry as this table.

And then in the spring we just had the hot winds. What really has been the killer are the winds. Sometimes you get some good snowpack but then you get the winds that just evaporate everything. The moisture disappears. Then, in the summer [of 2013], the moisture that we got never helped us with the crops that we had because it came late July
so by the time it came, a lot of these grasses were already dead, or they just grew a little. They didn’t have that head start in the spring. So last year was really, really bad.

My brother and I, we cut down to 22 head of cattle. We used to run 35, 40. But we had to cut because of less hay coming in. It just got to the point that [we couldn’t do it]. Years before we would bring in 24, 25, 26 hundred [bales of hay] just for us. The last few years cut it down to about 17, 18 hundred [bales]. This year, we barely brought in 800. We went to other fields, cutting with other people, getting hay here and there.119

Because of his reduced hay and alfalfa yields, Leroy said this is one of the first years that he will be entering into the spring season without a surplus feed reserve leftover from the year before. This may cause Leroy to have to reduce his cattle stock again, because as he declared, “As soon as the cattle don’t maintain themselves financially, they’re gone.”

Daniel, who is part of the El Salto Acequia Association, also explained how he has struggled in recent years to produce the hay yields that he used to:

Five, six years ago, I was producing three to six hundred bales, filling up three trucks with three trailers, twice a year. Back then you could barely sell it off for two to three dollars per bale because there was so much of it. This past year, I only got one cut [of hay], giving me somewhere between one and two hundred bales. The hay prices now are up to about ten to twelve dollars a bale. So if you think about it, feeding 45 sheep each day, which might go through like six bales, costs about 75 dollars a day. Now you can probably make more money selling hay than anything.”120

Daniel attributed his low hay yields to the little water available to him to irrigate his fields in the recent drought years, especially combined with other external pressures on acequias:

My land up in El Salto is on an acequia. We used to be able to irrigate for 4-5 days and now you can barely irrigate for 24 hours, which doesn’t do you much good. The [water] rights go back to the 1800s and they gave priority to livestock. But now that not many people have animals, the water goes towards people’s land, keeping their grass green and things like that irrigated. And since the land is generational there are a lot more people on the acequia system and the lots with the most people and biggest acreage get the most water. More people are moving into the area and everyone wants water. I have to attend meetings every five days and show up to make sure that I can irrigate my land. If I don’t show up, I don’t get water.

As noted by many interviewees, the year of 2013 in New Mexico was full of extreme and
unprecedented climate events both in Taos County, and across the state of New Mexico. Exceptionally dry conditions carrying over from 2012 resulted in Taos County being named a natural disaster area by the Farm Service Administration (FSA) as early as January 2013.\textsuperscript{121} A warm, windy, and dry spring led the rest of the state into drought as well. By June 2013, almost the entire state of New Mexico was classified as being in either extreme or exceptional drought by the U.S. Drought Monitor.\textsuperscript{122} In Taos County, water levels in the rivers, such as the Rio Grande del Rancho, were so low in June that some \textit{acequias} were not able to function as they normally do, prompting \textit{acequia} associations to negotiate a water sharing agreement with one another that had not been done since the 1930s. The associations decided that, instead of having the low-flowing water enter into all of the ditches at the same time, which resulted in a mere trickle in each ditch, the associations would consolidate the water and distribute it on a rotational basis to the ditches. Leroy, the commissioners of the Finado Francisco Martinez \textit{acequia}, had this to say about the decision:

\begin{quote}
We started distributing the water April 15, and normally we would be able to irrigate three people at once. But [because of the low river level] we were only able to irrigate one person at a time...It got to the point this summer where, it had never been done since the 1930s, but we had sharing between the ditches. Everybody had only a trickle and nobody could do nothing with it so we made an agreement where the ditches in Ranchos [southeast Taos] would get it for four days, the whole river, our ditch would get it for four days and the ones down the river with secondary rights were getting it for three days. And still you really couldn’t do that much with it…the ones that benefited the most were the ones with gardens and all that stuff and they were able to at least irrigate their gardens. But people like myself who have big fields, I tried that three times and you couldn’t really do much. When you’re flood irrigating you need a lot of water to really push the water so that it can soak your ground and move it on, and we just didn’t have that this year.\textsuperscript{123}
\end{quote}

One farmer’s \textit{acequia} ditch stopped running in June altogether. He explained that, “Our \textit{acequia} has been going dry in June for the past two years now…We think that might happen again in the [2014] year, or it might get worse.”\textsuperscript{124}
Taos County was not the only region to experience emergency drought conditions. On July 1, 2013, Navajo President Ben Shelley declared a state of emergency in response to the limited amount of drinking water available on the Navajo Nation, which spans the Arizona-New Mexico border. According to Shelley, some areas of the reservation have seen only about one-third of normal precipitation for the 2013 year, limiting the water supplies in the stock ponds and drinking wells. The declaration of a state of emergency resulted in emergency funding to be provided to tribal chapters for temporary supplies, as well as an appeal to President Obama for additional assistance.

New Mexico’s extreme drought conditions were headlined in Julie Cart’s article in *The Los Angeles Times* entitled “New Mexico is the Driest of the Dry.” It stated that that:

> Officials in Colorado say the state’s southeastern plains are experiencing Dust Bowl conditions, and the entire western U.S. has been beset by more frequent and ferocious wildfires...But nowhere is it worse than in New Mexico. In this parched state, the question is no longer how much worse it can get but whether it will ever get better—and ominously, whether collapsing ecosystems can recover even if it does.

The article went on to talk about how the past three years have been New Mexico’s driest and warmest since 1895 (the first year New Mexico began keeping climate records). According to Cart, this ominous trend is causing many ranchers, farmers, and land managers to treat the drought as a condition that may be here to stay. Indeed, following the emergency declaration by the Navajo, drought conditions continued to worsen across New Mexico until mid-July, when the arrival of monsoon rains improved some New Mexican counties’ drought severity classification.

However, Taos County failed to receive any substantial monsoon rains during this time, resulting in the entirety of the county being classified as in “exceptional drought” by August. According to the executive director of the Farm Services Administration of New Mexico,
Lawrence Rael, some Taos County ranchers sold off 60 to 80 percent or more of their cattle in the spring and summer of 2013 for lack of grass and water. Given that most ranchers in Taos County conduct small-scale ranching, owning somewhere around 30 to 60 head of cattle, a sell-off of that degree can take several years to recover from, says Rael, and that is if ranchers choose to not “give up entirely.”

Finally, in late August and early September, substantial and even remarkable precipitation came to northern New Mexico. As mentioned earlier, during the week of September 10, New Mexico and Colorado received unusual amounts of rain, resulting in a flood that brought up to 10 inches to northern New Mexico. The precipitation from this flood and additional monsoon rains resulted in another improvement in the drought conditions of most New Mexican counties, including Taos. However, as noted by Leroy and Frank, much of the precipitation that came was too late to have a positive impact, forcing many ranchers to either buy feed or reduce their livestock.

The September moisture helped to suppress drought conditions and bolster New Mexico’s water supplies until December 2013, when precipitation stopped altogether in most places. As precipitation dwindled throughout the winter, New Mexico’s drought conditions worsened. On February 4, 2014, north-central New Mexico received precipitation that broke a 43-day dry spell between the months of December and February, the longest winter dry spell ever recorded for this region. In a piece entitled “New Mexico in Its Worst Drought Since 1880s” in The Albuquerque Journal, writer, John Fleck, spoke to climate scientists about what is thought to be the worst drought since the 19th century across the state of New Mexico. One such scientist, Connie Woodhouse, found that a drought of this duration had not occurred in New Mexico since the dry spell of 1873 to 1883 when the Rio Grande endured four dry years, broken
by one average year, followed by an additional six years of drought. According to Woodhouse, the Rio Grande River is one of the best indicators of drought in New Mexico since it is the sum of winter snowfall in the mountains, and the lifeline for plants, animals, and humans across the Rio Grande Valley. The Rio Grande flow rate gauge at Otowi in north-central New Mexico indicates that only the years 2005 and 2008 were wetter than average since the start of the 21st century. Projections forecast 2014 as the sixth consecutive year in which New Mexico’s Rio Grande will run drier-than-average, making this the longest duration of low flow rates since the 1880s.

There are various discussions in the literature about what is causing New Mexico’s prolonged drought, and what it means for the future of New Mexico. According to Cart’s article, Chuck Jones, a senior meteorologist with the National Weather Service in Albuquerque and member of the Governor’s Drought Task Force, viewed the past three years of extreme drought as not necessarily indicative of a new climate pattern for the state; rather, Jones believed the dry spell could be just an aberration. Similarly, Connie Woodhouse believed New Mexico’s current prolonged drought may be just a repetition of the 1870s-1880s drought. For example, Historic Rio Grande flow rates show that there was a severe drought in the nineteenth century around 1870. When examining the reasons, some climate scientists attribute the drought to the “Pacific Decadal Oscillation” in which a stretch of abnormally cold water pools in the northern Pacific Ocean where it can remain for decades, inhibiting the formation of storms that normally bring winter precipitation to the Southwest. A similar pattern also occurs in the Atlantic, the “Atlantic Multidecadal Oscillation” which is thought to be responsible for causing serious drought when it coincides with the Pacific Decadal Oscillation. Some climatologists think that these two oceanic conditions are fueling the current multi-year drought in the Southwest.
similarly to how they fueled prolonged drought conditions in the 1870s, as well as possibly during the Dust Bowl and the drought of the 1950.

However, there is a group of scientists looking at the health of New Mexico’s Chihuahuan desert that see a longer-term trend:

Federal scientists are grimly watching a rare ecological phenomenon unfold here, a catastrophic alteration known as ‘state change’—the collapse of the vast Chihuahuan Desert grasslands ecosystem and its transformation into a sandy, scrub desert affording little forage for wildlife or livestock.\textsuperscript{140}

As these scientists and experts from the USDA surveyed the New Mexican landscape, they noted that the 10,000-year-old, 140,000 square-mile desert is changing as native grasses, such as black grama, are in collapse, being outcompeted and replaced by drought-tolerant shrubs.\textsuperscript{141} While some scientists blame drought and cattle grazing for contributing to the changing landscape, they sited “an altered climate” as being the strongest driver of the landscape-wide changes occurring across the West. Brandon Bestelmeyer, researcher for the Department of Agriculture, conceived of these state changes as not only climate change related, but also as “catastrophic” and potentially “irreversible.”\textsuperscript{142} Bestelmeyer fears that if grasslands and vegetation continue to die off, desertification will accelerate and the Chihuahuan desert will expand, leaving a stripped landscape incapable of transporting water to restore aquifers or of supporting cattle and people.

If New Mexico’s Chihuahuan desert is, in fact, in collapse, this will have a devastating impact on Taos County’s grasslands, and therefore, its ranchers. The far northern reaches of the Chihuahuan desert extend into Taos and the health of its grasslands is critical.\textsuperscript{143} As seen in the case of Frank, the health of the grasslands is essential in terms of the ability of livestock to survive off of the land without supplemental feeding. Poor grassland health also contributes to dust storms and soil erosion.
The perspectives on climate change by ranchers that I interviewed varied from person to person. Some ranchers, such as Leroy, who have seen recurrent cycles of drought throughout the decades, viewed climate as cyclical:

I really don’t believe in the global warming thing. I more believe it is just cycles of patterns. La Niña, El Niño has a big effect. I think it’s cycles of the earth that we go through in a period of time. A lot of people don’t realize. Because in the early ’50s, it was really dry, I remember part of the ’60s, when we were raised seeing the sandstorms over this area. And along the roads here, you would get nothing but fine dirt like you had run it through a screen. Real, real fine. And around here there was nothing else and you could see the outside of the gorge bridge and the sagebrush over there, you could see what you see in the movies in Iraq and Phoenix with the dust and all that. So the droughts have been there like every 10 years. But to me, I do see that we used to get a lot more snow. More drifts, and now, it’s different. But I don’t know how much as far as records and science will show you.144

Other ranchers, such as Richard, who had in the past viewed climate as cyclical, now are beginning to view the climate as perhaps changing permanently:

Some ranchers, they depend on the farmer’s almanac. There are a lot of people that do that. But I don’t think it’s accurate. Not anymore. I don’t think…I guess some people would think that way, huh, that it’s just that cycle that happens to hit us but when you have record breaking temperatures, and record breaking drought, whatever it is…it gets you to wonder if the glaciers have ever melted like that before…145

And for Francisco, the discussions about water and climate change in New Mexico have grown stale. Francisco, the president of an acequia association, expressed his frustration in dealing with government officials and land developers during the current times of water stress:

All this water policy stuff, the adjudications and all that to me is like building a house, and we just put a roof on it. But this house doesn’t have a foundation. Because we have appropriated water, we have commodified water, we have quantified water in volumes that don’t exist. So they’re trying to make up for all of this water equation shenanigans by mining ground water. And it’s only going to be a matter of time till we dry this whole place up. And I’m tired of telling ‘em. It’s like screaming at a wall… And then they get all arrogant with me, like they know more, like they have more experience in these matters or more important, better information.146

The future of the 2014-year irrigation and planting conditions are what one speaker at the
Northern New Mexico Stockmen’s Association described as “a waiting game, where you just
pray for snow, and pray for rain.”\textsuperscript{147} Toward the end of our discussion, Leroy gave an
unprompted summary of the conditions of ranching in Taos County. His stream of
consciousness lends critical insight into the complexity with which climate is acting with other
factors to shape what the future of ranching looks like in Taos County:

After the 2013 year of wind, drought, dead alfalfa, soil erosion, there’s a lot of fields that
are gonna need a lot of work. We’re gonna have to re-seed, re-plant, re-plow a lot of
fields because there’s nothing there. So it’s a lot of cost and for a lot of people, it’s just
been tradition that they’ve done this. A lot of people might have one acre or a couple
acres and they cut the hay and sell it, make a little money from it. Years ago, they used
to make a living out of that, they had to. Now, like I said, it’s been kinda like a tradition,
and really there’s not much money to it.

Everybody up to 2002, had five, ten head of cattle maybe. They had a little land, like I
do at the bottom down there, where they used to keep them. But after ‘02, a lot of people,
they sold out. And then the younger generations are moving to Albuquerque or
somewhere else. All my kids live in Albuquerque and Belen, because of work. And it’s
not that you’re gonna make a living [on ranching] nowadays. If you’re gonna make it,
you’ve gotta be a big time farmer rancher, a hundred cattle or above. And that requires
that you have a lot of land also. So, it’s kinda whether you’re gonna be in it for the
duration. To us, it’s just a tradition. Right now I could just cut the cows and it doesn’t
affect my salary because I already have my retirement and everything else. But what I’m
trying to say is, a lot of people that sold their cattle then, [in 2002], they have never come
back. So every time you have something like this, you’re losing people. So right now,
there are more horses in this valley than there is cattle. The sheep are nearly gone.\textsuperscript{148}

The different perceptions of climate change by Leroy and other interviewees are filtered
through cultural and social norms specific to Taos: the Spanish \textit{acequia} culture, regionally-
adapted grazing practices, and \textit{querencia}, a way of thinking about one’s position in the
environment, as well as their personal experiences. Yet, the realities of climate change, whether
cyclical or permanent, are one more element in a perfect storm that can push ranchers over the
edge.
One Man’s “War”

In the midst of a changing way of life for ranchers and many others in Taos County, there is one man who is waging what he calls “a war” against the effects of climate change and cultural degradation, while empowering local youth in the process. Francisco, the high school biology teacher mentioned earlier, is focusing on student retention. Most of his students are Hispanic and, for many of them, this is their “last chance” at graduating. Francisco is enthusiastic about getting youth connected to agriculture and to their cultural heritage. Over the past twenty years, he has created what he calls “a small army of student farmers.”

I met with Francisco in his classroom to learn more about his current projects with students. His classroom, the same one in which his grandmother taught, was no typical science classroom. Scattered around the room were buckets of seed, maize, and gardening tools. In the backyard of the classroom was a “grow dome,” a spherical greenhouse in which his students grow various fruits and vegetables. Certainly, Francisco is an exceptional teacher. He has the qualities of a motivational speaker, expressing himself with an eloquence and confidence that demands attention. He explained one of his current projects that engage students with the land and their ancestral foods:

Of course every kid wants money, but if they want money, they’re gonna go deal drugs, or they’re gonna go get a regular job. They’re not gonna think agriculture is a money making opportunity. At first. But they are gonna see it as a way to get interested, to participate, to be creative.

We built an horno [a traditional mud brick oven] this year, and we’re making chicos [dry roasted corn kernels]. And every Northern New Mexican I know eats chicos for the holidays. You know we all eat posole, we all eat tamales, so that’s how I do it, I get ’em through their cultural foods…. And they don’t realize that there’s a lot of knowledge that goes into it. You know, you can’t just have chicos. You have to have an horno, you can’t just build an horno. There’s how you mix mud. You can’t just mix mud. You gotta know what kind of soil you’re getting. So there’s this whole body of knowledge that once students make chicos, then I can instill in them a pride over what they’ve done. [I tell them] you know where to get the soil in the mountains, you know how to mix the mud,
you know how make the bricks, you know how to build an *horno*, you know how to grow the corn, you know how to harvest it … you know how to do all this stuff. So every time you have *chicos*, someone had to do all that, and now you know how to do it too.¹⁴⁹

Francisco is also introducing his students to the innovative work that he is doing in seed banking. Seed banking is a traditional method of farming in which seeds are salvaged from successful crops for use in the following growing season. Francisco plants a series of crops, often in water-stressed environments, and saves the seeds of the individual plants that survive. This process produces seeds that are the result of Darwinian selection and can be used to plant next season’s crop. Through his work, Francisco has evolved garbanzo bean seeds that, when planted, successfully produce beans without ever being watered. He told me:

I drive myself nuts every year trying to save all my seeds, but if something happens, I’ve got the seed for this whole county. I could. I have five gallons of sweet corn right there and that’s just the start. I’ve got a seed bunker in my house. So you know, I’ve been doing this in a very small way. If we could do this in a large way, hey, there’s gonna be no problem… and I could get hit by a bus on the way home and my students will know what to do… So as far as I’m concerned, we’ve already won.

Seed banking, Francisco explained, is a practical answer to today’s climate conditions. Seeds adapted to water stress and poor conditions will become increasingly important. As far as Francisco was aware, he was the only one in the Taos area conducting extensive seed banking. Seed banking can also be applied to ranching in the production of crops like alfalfa. By developing more resilient alfalfa seed, the impact of water stress could be lessened. However, since Francisco is not a rancher, a new initiative is needed to begin a seed banking project geared specifically towards ranching.

Francisco asserted that individuals, not government, are going to have to solve today’s problems, and he is equipping his students with the knowledge and skills to be creators in their communities. Francisco’s hope is that students will walk away from his class with more than
just the technical skill to participate in the agricultural traditions of northern New Mexico; he
hopes students also will leave with a sense of pride in their cultural heritage and in themselves.
Francisco concluded with this statement: “I’ll be doing this research for the rest of my life, and
you know, maybe eventually someday somebody will notice and it’ll mean something.”

There are other initiatives in northern New Mexico to create new generations of
sustainable ranchers and foster agricultural interest amongst New Mexico’s youth. The Quivira
Coalition is a nonprofit organization based in Santa Fe that works to build “economic and
ecological resilience on western working landscapes.” Through their New Agrarian Program,
the Quivira Coalition partners with young people who have an interest and commitment in
ranching and environmental stewardship, offering them hands-on apprenticeships. Interestingly,
half of the recent applicants for apprenticeships over the past couple of years have been women,
according to Virginie Pointeau, the program director. Apprenticeships like these offer youth an
affordable opportunity to be trained in agriculture and food production by local ranchers who are
also dedicated land stewards.

To financially assist existing ranchers in Taos County, Carlos created a local program to
alleviate the costs ranchers face in transporting livestock they want to sell to USDA certification
sites. As noted earlier, in order for ranchers to sell their meat products on the commercial
market, they have to certify every animal they butcher. Since USDA certification sites are often
far away, Carlos, in collaboration with the Taos County Economic Development Corporation,
established the Mobile Matanza, a mobile USDA certification trailer that offers affordable, local
USDA processing. This has allowed local ranchers to locally certify their meat products so that
they can conveniently sell them to Taos buyers and restaurants.
Conclusions

The frequency with which current literature cites climate change as a primary threat to the viability of agriculture in the southwest led me to expect that my research in Taos County would simply give me further insight into the details of how climate threatens small-scale ranchers. The interviews conducted indeed confirmed that the impact of climate change and prolonged drought on Taos ranching is acute, forcing many ranchers to critically examine their futures. However, the interviews also revealed an unexpected set of contemporary pressures acting on ranching that extend beyond climate. People’s stories demonstrated that the viability of ranching is strongly impacted by factors such as the commercial development of the Taos area, a shift from labor on family farms to jobs in urban careers, the loss of local youth to immigration, and top-down actions taken by national government agencies in regards to land-management. These stories emphasize that there are forces besides climate change that present major threats to ranching.

The modern-day challenges reported by ranchers in their everyday lives are coupled with the scars of historical injustice that have undermined Hispanic ranchers and their communities since the nineteenth century. The reduction of ranching from a full-time occupation to a part-time avocation is largely attributable to the loss of Hispanic common lands to the government when New Mexico became a state. These losses led to ranchers being a historically economically disenfranchised population. The U.S. government’s appropriation of land grants not only exploited Hispanic landowners, but also disrupted a unique sociopolitical system based on collaboration and reciprocity. The result was a dramatic shift in the foundations upon which traditional ranching was established and practiced. The loss of common lands signaled the transition of ranchers from landowners to permit-holders, and the beginning of top-down land
management policies that treated Hispanic ranchers less favorably than their Anglo counterparts. Thus, even in an ideal drought-free environment, the future of ranching is imperiled by a set of adverse social, economic, and historic conditions. This finding raises the question: how much longer will ranchers be able to survive within the confines of these difficult pre-existing conditions, in what is also a changing climate?

Many of the ranchers interviewed saw the future of ranching in Taos County as uncertain in the face of climate and sociopolitical change. Years of extreme water stress, such as 2012-2013 already forced some ranchers to surrender their livestock in what was an increasingly impossible environmental and economic climate. If New Mexico is indeed experiencing a climatological “state change,” as suggested by some studies, ranching will only become more difficult. The current year is expected to produce another dry and warm growing season, which, if combined with stringent grazing restrictions in the Carson National Forest, will present a situation in which ranchers may need to make additional cuts to their livestock herds. With rising property taxes, decreasing ground water supplies, and an aging population of agriculturalists, Hispanic ranching communities are in a precarious position.

Additional studies are needed to investigate the resilience of small-scale ranching in the face of evolving climate patterns. Further study of the demographics of ranching will also better reveal youth’s role in the future of ranching and agriculture in the 21st century. The contribution of this thesis is the light it sheds on the often-obscured individual perspectives and experiences that inform us about this future. Indeed, this study is an example of cultural anthropology’s ability to capture stories that do not frequently appear in mainstream media, or that are overshadowed by dominant economic, historical, and political discourse. Indeed, the perspectives of the ranchers and community members featured here are those that are often
neglected by political and corporate sectors: perspectives of people who are rural, members of minority groups, are retired or veterans, and who are historically marginalized. This study demonstrates that the values embedded within these perspectives—collaboration, reciprocity, and environmental respect—are relevant to today’s greatest concerns over climate change and inequities in power and culture.

In the face of both past and future hardship, there was a common thread that emerged throughout the interviews: hope. Despite the numerous changes occurring around them, ranchers expressed a humble sense of being in a place they felt they belonged and in which they were able to interact daily with the land and the animals about which they care so deeply. This sense of place, *querencia*, gave ranchers a purpose with which they conduct their work, raise their children, and is evident in the responsibility they feel in continuing traditions of land stewardship.

Ranchers’ hopes for the future were not about regaining control over lost land, rather that whoever is in charge of the land share the same level of respect for the land and the water that they do. Many ranchers simply communicated a desire to be treated with respect in regards to their culture and history, and that Forest Service and political figures acknowledge local ranchers as dedicated land stewards. As expressed by Leroy, Taos ranchers want the opportunity to be able to collaborate with outsiders of the community in the co-creation of solutions to today’s problems. Many ranchers and community members were eager to share their experience and expertise with those who were genuinely interested in engaging in a reciprocal exchange of knowledge. Ranchers hoped for a more productive relationship with the Forest Service in which rangers will be willing to “get their boots on the ground,” and supplement their scientific research with local knowledge. However, this will require agencies to trust and respect local
ranchers, and to honor the history and cultural traditions of the area. For now, ranching remains a threatened “way of life.” Yet, in the words of Carlos, “I wouldn’t trade it for anything.”
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Appendix

Geography of Taos County

Sharing a border with Colorado, Taos County is situated on the eastern portion of an altiplano, just before the land lifts to form the southern Rocky Mountains. Running north-south and cradling around the east is the Sangre de Cristo Mountain range. Based in the desert-like Rio Grande Valley, the Sangre de Cristos culminate in the 13,161-foot alpine tundra of Wheeler Peak, the highest point in New Mexico. Between these two extremes lie “as many as nine or ten discrete ecological zones, depending on how one classifies them.” The west is composed of the flat Taos Plateau, separated from the mountainous east by the Rio Grande Gorge, which bisects the county.

Taos County is a semi-arid climate, dominated by piñon, Juniper, and shrub land. In Cerro (northwest of the town of Taos) there is a Western Regional Climate Center (WRCC) station that collects temperature and precipitation data for Taos County going back to 1932. According to WRCC records, the county’s mean temperature (1932 to 2006) is 64°F in the summer, and 24°F in the winter. The mean annual precipitation for the county is 12.68 inches, with a mean annual snowfall of 58.1 inches.

Eight water tributaries run down from the Sangre de Cristos into the Taos Valley, where they eventually drain westward into the Rio Grande River. Each of the tributaries stem from a high lake or spring in the mountains, descends an alpine canyon into the valley, and finally, is channeled into an acequia arroyo where it provides irrigation to agricultural land. The acequia ditches make ranching and farming viable in the Taos Valley by delivering water to areas in the lower watershed that otherwise would not receive any irrigation.
Also essential to ranching in Taos County are the surrounding mountain woodlands, or what became the Carson National Forest (CNF) upon New Mexico being absorbed by the U.S. in 1848 with signing of the Treaty of Guadalupe Hidalgo. The CNF totals 1.5 million acres and is managed under the United States Forest Service in which it is designated for mixed uses such as recreation, grazing, and resource extraction.\textsuperscript{158}
U.S. Drought Monitor Images

Figure A

Figure B

Figure C

Figure D

Palmer Drought Severity Index
August, 2013

Yellow: D0 - Abnormally Dry

- Orange: D1 Drought - Moderate

- Red: D2 Drought - Severe

- Dark Red: D3 Drought - Extreme

- Dark Brown: D4 Drought - Exceptional

Source: U.S. Drought Monitor Weekly Comparisons
Summary of Amy Miller’s Climate Change Analysis of the Arroyo Hondo Watershed, Taos County New Mexico

This section contains the findings of a climate analysis conducted by Amy Miller in 2013 as part of her study “Assessing Change and Resilience in a Northern New Mexico Acequia Irrigation Community,” in which she did a thorough analysis of the Rio Hondo watershed in Taos County and how its acequias have responded to changes in land use, climate, and demographics over time. The Rio Hondo watershed is one of the major tributaries that feed into the Rio Grande from the Sangre de Cristo Mountains. The tributary runs east-west and is located northwest of the town of Taos. As part of her study of how changes in climate have impacted Rio Hondo acequias, Miller did a data analysis of climate trends of the following: the Rio Hondo stream flow since 1935 using a USGS Water Information System Web Interface, temperature for the years 1895 to 2011 using the PRISM climate mapping system, precipitation (also using the PRISM database), and snowpack using the SNOTEL (SNOwpack TELemetry) site managed by the Natural Resources Conservation Service (NRCS) located in the Taos Ski Valley. Below are the findings of each climate study.

Stream flow of the Rio Hondo

Stream flow data were collected from the USGS Water Information System Web Interface at Valdez, NM (northeast of Taos). Miller used the Mann-Kendall trend test in her analysis of all the trends in the climate data, a test chosen specifically for its accuracy in working with hydrological data, which commonly contains outliers, skewed data and may follow an irregular distribution. In compiling annual stream flow averages for the Rio Hondo from year 1935 to 2009, Miller revealed great variance in flow, with the lowest flow rate occurring in 2002.
and the highest in 1942. The data revealed an overall downward trend in annual average flow of the Rio Hondo; however, “the Mann-Kendall trend test showed that this trend is not significant at the 95% confidence level.” The same lack of confidence is true for the downward trend in seasonal flow rates, such as those from May through September, which are also statistically insignificant according to the Mann-Kendall trend.

![Annual Average Rio Hondo Flow (cfs)](image)

**Figure 16: Annual Rio Hondo Flows for Each Water Year (1935 to 2011)**

*Source: Miller 2013:52*

**Precipitation**

Miller collected precipitation data with the PRISM mapping system located at Valdez, NM “which uses actual point measurements of precipitation and temperature, a digital elevation model, and expert knowledge to create a continuous grid of monthly and yearly climate parameters.” Available PRISM data runs from the year of 1896 to 2011. Precipitation trends in New Mexico and in Taos County are variable and do not reveal a clear trend. The year of least precipitation ever recorded in Valdez was in 1956 with 7.07 inches and the year of highest precipitation was 1986 with 20.25 inches. While the overall precipitation across all calendar
years indicates a total increase of 13.4 inches, the Mann-Kendall trend ruled this trend statistically insignificant.

![Annual Precipitation](image)

**Figure 21: Annual Calendar Year Precipitation at Valdez, NM (1895-2011)**

*Source: Miller 2013:55*

*Temperature*

Miller also employed the PRISM climate mapping system to conduct a historical temperature analysis of the Rio Hondo watershed from years 1985 to 2011. Monthly maximum and minimum temperatures for both the warm and cold seasons were downloaded and incorporated into a grid cell that considers the longitude and latitude of Valdez, where the PRISM site is located. Unlike the irregular precipitation and stream flow trends of the Rio Hondo, temperature of the Rio Hondo demonstrates a regular upward trend for all seasons, meaning that the climate in Valdez has warmed over the previous centuries. The first half of the 21st century hold the warmest years, with the warmest peak seen in the 1950s, correlating with
the low precipitation rates seen in 1956. According to the Mann-Kendall trend test, the accuracy of the temperature trends is as follows: the maximum temperature trends for both the warm and cold season prove significant at over the 95% confidence level, the minimum temperature trend for the warm season is significant at the 90% confidence level, and the minimum temperature trend for the cold season is statistically insignificant.

Figure 19: Maximum Temperatures at Valdez, NM (1895-2011)

Figure 20: Minimum Temperatures at Valdez, NM (1895-2011)

Source: Miller 2013:55
Snowpack

The Taos Ski Valley contains a SNOTEL (SNOwpack TELemetry) site monitored by the Natural Resources Conservation Service (NRCS) that collects data on snow water equivalency (SWE). As stated by Miller, snow water equivalency is “the amount of water contained in snowpack and is the depth of liquid water that would result from melting snow.”

The NRCS site is located at 11,507 feet near Wheeler Peak, the highest peak in the state of New Mexico, and records SWE measurements for the first of every month from January to May. Miller downloaded SWE measurements for the months of February, March and April going back to 1974; the months of January and May only extended back to 1989, too short of a time period to achieve the 30 years of data mandated to complete an official climate change assessment in climate statistics.

Miller’s SWE measurements for the months of February, March, and April since 1974 indicate consistently low snowpack between the years of 2000 and 2005, with the lowest snowpack ever measured occurring in 2006. The highest SWE was recorded in 1979. While all the months of February, March, and April reveal a slight downward trend in their SWE measurements from 1974 to 2012, Miller was able to detect stronger downward trends for SWE during April as opposed to the months of February and March. However, none of these trends were deemed statistically significant by the Mann-Kendall trend test.
Drought

The final component of Miller’s climate analysis is that of drought severity, measured by the Palmer Drought Severity Index (PDSI). The PDSI “attempts to measure the duration and intensity of the long-term drought-inducing circulation patterns;” thus, the PDSI of a given day is a result of both the current drought conditions, and also the cumulative drought patterns of the prior months. The PDSI, available from year 1895 to 2011, is calculated monthly and its values generally range between six (extreme wet conditions) and negative six (extreme drought), as can be see in figure 1.0 below. There are a few important characteristics of the PDSI statistic to keep in mind upon analyzing them: first, the PDSI treats all precipitation as rain, limiting its accuracy in high elevations where lots of precipitation falls as snow. Second, the PDSI is based on meteorological drought, not hydrological drought, meaning that it considers drought in terms

Source: Miller 2013:57

Figure 22: Taos Powderhorn SWE Measurements (1974-2012)
of how dry a region is compared to the average and length of the dry period, as opposed to considering a lack of precipitation and its impact on human water supply, as hydrological drought would consider.

Miller downloaded PDSI data from the National Climatic Data Center for the Northern Mountains Climate Division in New Mexico, upon which she graphed PDSI values for the New Mexico Northern Mountain Climate Division from 1895 to 2011. As can be seen in her figures PDSI values decrease significantly over time, which indicates a drying of the region, as the smaller the PDSI value is, the more dry the climate condition. When tested for accuracy with the Mann-Kendall trend test, this negative trend proved statistically significant at the 95% confidence level.

However, as discussed by Miller, there is a disagreement amongst climatologists as to whether its is appropriate to use PDSI trends as an indicator of climate change due to the fact that the PDSI statistic was created to measure climate variability, not climate change, based on a defined climate condition (referred to in the literature as a climate mean). The difference is that climate variability is a change in climate statistics detected over a period of time less than 30 years, whereas climate change implies a change in climate statistics that takes place over more than 30 years. Because the PDSI operates upon a defined climate mean of a given region, when a region’s climate mean changes due to warming the PDSI value will also shift, therefore not capturing the complete change in climate over time. In this way, the PDSI can effectively underestimate the actual change in climate, which in this case is the drying of New Mexico.
Conclusions of Miller’s Climate Study

Several trends emerge from Miller’s study that are informative about the climate of Taos County. The first is that Taos County is experiencing warming temperatures of both its cold and warm seasons. Some effects of increased temperatures (considered in isolation from other climate factors) include: increased evaporation of precipitation falling as both rain and snow,
decreasing water levels in rivers and tributaries, less precipitation falling as snow, earlier spring
snowmelt, and increased drought severity and extreme weather events.

The second trend is that New Mexico, including Taos County, has historically
experienced irregular cycles of dry and wet periods, and continues to do so today. From analyses
of the stream flow of the Rio Hondo, snowpack at Taos Ski Valley, and the precipitation records
going back to 1895, there are no clear trends deemed accurate by the Mann-Kendall trend test
that indicate how precipitation has changed in Taos County over time.

However, there is a statistically significant trend detected in the PDSI drought index in
Northern New Mexico, showing a gradual increase in drought over time since 1895. Thus, while
ranchers and agriculturalists of Taos County have historically endured dry spells and severe
droughts, as is evident in the precipitation records, the fact that drought conditions have
continually worsened since 1985 is significant in that it indicates present and future drought
conditions may be worse or more frequent than they were in the past.
21-Nov-2013

Exempt Certification

Brinker, Sonja

Protocol #: 13-0675

Title: Socio-economic and cultural impacts of climate change in Taos County, New Mexico: The local implications, experiences, and perceptions of a changing climate

Dear Ms. Brinker,

The Institutional Review Board (IRB) has reviewed this protocol and determined it to be of exempt status in accordance with Federal Regulations 45 CFR 46.101(b). Principal Investigators are responsible for informing the IRB of any changes or unexpected events regarding the project that could impact the exemption status. Upon completion of the study, you must submit a Final Review via eRA. It is your responsibility to notify the IRB prior to implementing any changes.

Certification Date: 21-Nov-2013
Exempt Category: 2

Click here to find the IRB reviewed documents for this protocol: Study Documents

Note: The Protocol Document submitted to the IRB should be the final clean version of the document. For future reference, please ensure all tracked changes (with the exception of any required modifications or Amendments) are cleared before submitting.

The IRB has reviewed this protocol in accordance with federal regulations, university policies and ethical standards for the protection of human subjects. In accordance with federal regulation at 45 CFR 46.112, research that has been approved by the IRB may be subject to further appropriate review and approval or disapproval by officials of the institution. The investigator is responsible for knowing and complying with all applicable research regulations and policies including, but not limited to, Environmental Health and Safety, Scientific Advisory and Review Committee, Clinical and Translational Research Center, and Wardenburg Health Center and Pharmacy policies.

Please contact the IRB office at 303-735-3702 if you have any questions about this letter or about IRB procedures.

Douglas Grafel
IRB Admin Review Coordinator
Institutional Review Board
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Improvements in drought severity classification are referred to by the U.S. Drought Monitor as a category improvement. For example, if a county’s drought conditions drop from extreme drought to severe drought, this is a “category-1 improvement.” (see figures A-D in appendix)
U.S. Drought Monitor Weekly Comparisons 2013 (See footnote 126 for explanation of “category-1” improvement

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