

**Introduction:**

Although the Spanish call it the Rio Grande, the river has been called countless things before the arrival of Europeans over 450 years ago. To record some of the first names given to the Rio Grande is to recognize the deep connection between the people and the river. As Carroll L. Riley notes in *Rio Del Norte: People of the Upper Rio Grande from Earliest Times to the Pueblo Revolt*:

Our first recorded Indian names for the Rio Grande come from Pueblo Indians who lived along the river in Coronado's day and who live there still. These names probably go back at least two or three centuries before Coronado's time, and in translation they mean much the same thing. The Keresan speaking Indians of Cochiti Pueblo refer to the river as mets'ichi chena, which simply means "big river." The Tewa speakers call the river posoge, which also means "big river," and the northern Tiwa use the name paslápaane, with roughly the same meaning. The Towa speakers of Jemez Pueblo say hañapakwa, which means "place of the great waters."

When humans name something, we give it an identity that establishes a relationship. The relationship between the Puebloan people and the river now known as the Rio Grande was life sustaining for the first inhabitants of the Rio Grande Valley. The river provided the Pueblo people with life; Pueblo ceremony thanked the river and ensured that the people would be sustained another year. Immediately seeing the importance of the river, the Spanish gave it a name as well, the one it is still known by today.

The Rio Grande is almost 2,000 miles long, beginning in the mountains of Colorado, winding through New Mexico, and eventually emptying into the Gulf of Mexico. Today, millions of people depend on the Rio Grande for drinking water, agriculture, and ceremonial purposes. With so many people living along the river, it now faces an uncertain future. Climate change, population growth, damming, and agricultural runoff have threatened the Rio Grande, causing it to be listed as an "endangered river" in 1993, 1994, 2000, and 2003 (Thomas-Blate, 2011). Some

years, the river fails to reach its end in Mexico due to overuse by residents on both sides of the border, the damming of the river in multiple places, and decades of drought throughout the Southwest (Howard, n.d.).

Today, the river is polluted, eroded, and dried out. It is easy to look at the river today and dream of returning the Rio Grande to its original course and ecosystem. It is easy to look at the river, filled with sandbars and lined with invasive species, and curse humanity's impact. It is easy to look at the canals and dams and wonder, "why couldn't we just leave it alone?"

The truth is humans have never left the Rio Grande alone, but in the modern age human interference has reached an irreversible degree of damage.

Whether the work of small groups of Native people, Spanish settlers, the US Army Corp of Engineers, or large-scale agriculture, humans have altered the Rio Grande for thousands of years. However, prior to permanent dams, large-scale engineering projects, and rapid population growth, human impact on the Rio Grande was minimal. Today, the building of permanent dams has altered the river so much it is no longer free to flow as nature intended.

Between Cochiti dam and the city of Albuquerque the water flow of the river is controlled based on agricultural needs and the needs of the endangered silvery minnow (conversation with John Fleck, 2016). According to Fleck, a retired journalist from the Albuquerque Journal who wrote extensively on Rio Grande water issues, no one knows what the Rio Grande was like before humans started to alter it. Today, a forest has grown along the banks of the Rio Grande - the product of only the last 15 to 20 years of water management practices. It is an almost entirely new ecosystem that would most surely look completely foreign to the Native people who inhabited the area as well as the Spanish who "discovered" it.

People have inhabited the Rio Grande Valley for thousands of years, many villages and farms had been established along the river for hundreds of years before the arrival of the Spanish.

Beginning the history of the Rio Grande with Native uses is essential to understanding how humans have altered the environment and waterways of New Mexico. Today's residents of the Rio Grande Valley must understand how the river got to be what it is if they are to make informed decisions about future use.

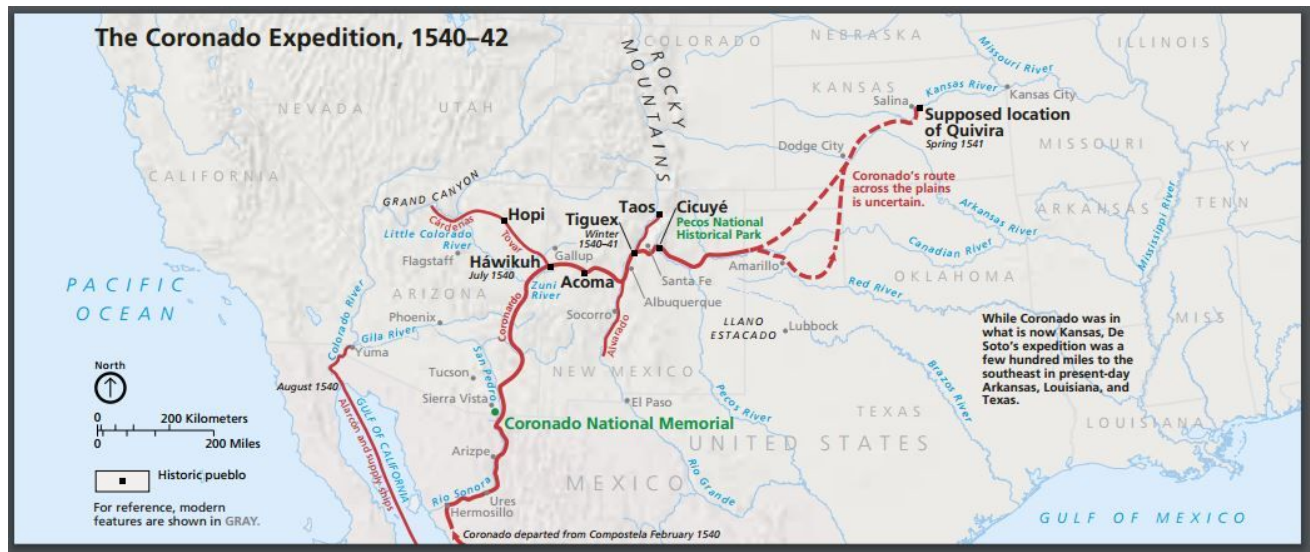
An all inclusive history of the Rio Grande is challenging to piece together as written records only begin with the arrival of the Spanish in the 1500s. A complete history is impossible without including oral traditions - stories passed down from generation to generation to connect people with their origins, history, and values. Ultimately, the *Disappearing Rio Grande* project will include these stories to paint a more complete portrait of the history of the valley, but the archaeological record will be the primary focus of this paper.

The Rio Grande tells a long story of humans altering the river; modern technology and agricultural practices are only the latest chapter in this tale. When Spanish conquistadors arrived in the 1500s they noticed different forms of water control had been taking place to allow farming for hundreds of years. Native people altered the river, the landscape, and resources to make habitation of this dry region possible. It is impossible to know what an "untouched" Rio Grande might look like.

Despite this long history of people using the Rio Grande, when learning about the history of New Mexico and the Rio Grande Valley many scholars and textbooks begin in 1539 when the first European arrived from Spain and visited the Pueblos of New Mexico (Bandelier, 1937). Pueblo is the Spanish word for village.

This first European to arrive in present day New Mexico was Fray Marcos de Niza, a Franciscan friar who had traveled throughout Central America and Peru and had extensive knowledge of navigation (Reff, 1991). In July of 1540 Francisco Vasquez de Coronado reached Zuni, searching for riches to justify continuing Coronado's expedition throughout the Southwest to the

crown (Reff, 1991). A month later in August, Coronado sent Captain Hernando de Alvarado and a priest, Fray Juan de Padilla, and a few men east.<sup>1</sup>



In September 1540 they reached the Rio Grande and found villages filled with Native people. Padilla and his men reached the villages of the Tiwa people near present day Albuquerque (Riley, 1995). Coronado and his men left the area in 1542 and the Spanish did not return until 1581 (Riley, 1995).

Not even 60 years later, by 1598 - the Pueblo people had been almost entirely colonized by the Spanish (Bandelier, 1937) and the history of New Mexico and the Rio Grande was forever changed.

### **Pleistocene Era:**

The history of New Mexico was rich well before the Spanish arrived. Combining archaeological evidence with Pueblo oral traditions gives us the best understanding of pre-European arrival. Prior to written language, all humans told history, stories, or lessons through oral traditions. Tribes throughout New Mexico have different origin stories that tells the history of their

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<sup>1</sup> Coronado's expedition, National Park Service

ancestors. Many involve the land, mountains, and animals of the region. These stories help us understand the importance of respecting the land, and can also help residents today understand when some people established villages and farms along the Rio Grande.

Humans arrived in the Southwest about 25,000 years ago, towards the end of the Paleolithic period. They were small groups of nomadic people who hunted the megafauna during the tail end of the Pleistocene era (Black et al., 2011). The end of this period of time resulted in the creation of lakes and rivers throughout North America where huge mammals gathered - Paleoamericans, the first people in the region, would follow them to these waterways to hunt.

The first evidence of basic tool construction such as rocks with pointed edges are evidence of people living in the northern Rio Grande area at the end of the Pleistocene era, approximately 15,000 BC (Wendorf, 1954). Primitive tools dating to this time period were found at sites in present day Albuquerque, along the Chama River, a major tributary of the Rio Grande in northern New Mexico - as well as in the Manzano and Isleta Caves south of Albuquerque (Wendorf, 1954). Around 10,900 BC the largest of these megafauna were wiped out, either due to the explosion of a large comet or hunting of the animals to extinction (Black et al., 2011).

Hunting sites were discovered dating to about 7500 BC, which marks the decline of these Paleoamerican cultures. By this time, early hunters had made their way to the Rio Grande, Rio Puerco, and San Juan rivers and tributaries (Black, et al 2011). These Native tribes had become such expert hunters by this time that they could kill two hundred bison at a single time (Black, et al 2011). The ability to harvest so many animals in one sitting could be evidence of a growing need for food with a larger population, advances made in hunting weaponry, or both.

Unfortunately for these hunters, the climate changed again and the region entered a 2,000 year period of high temperatures. Average temperatures were higher than modern times - these changes resulted in the drying up of grasslands which caused the bison to stay in modern day Colorado, Nebraska, and Wyoming and abandon New Mexico (Black, et al 2011). This climate

change had a profound impact on the Paleoamericans of the Southwest and they were forced to focus primarily on hunting and gathering until they would eventually settle in the Rio Grande Valley thousands of years later (Black, et al 2011).

This early evidence of human existence emphasizes a number of things. First, that humans lived and hunted along waterways throughout the Southwest. As is commonly said in the Southwest, and especially by Native people to this day, “water is life.” Archaeological evidence shows that nomadic people did their hunting along the river, especially the waterways associated with the Rio Grande. Recovered tools also show that early in human existence, humans put themselves at an advantage when hunting game. The ability to kill large numbers of big game most likely altered the ecosystem, migration patterns, and the way the tribes lived day to day. The use of tools would forever change the relationships between humans and their environment, and eventually the Rio Grande. However, it is important to remember that despite the ability to harvest large numbers of big game at a time, human populations were still relatively small at this time, and the impact the nomadic people had on the land was most likely a temporary one.

In the Rio Grande Valley, scholars identified four linguistic types among these Pueblos: the Keresan, Zunian, Tanoan, and Shoshonean (Hewett, 1945). A variety of dialects were spoken within these four main languages and scholars eventually realized that the Shoshonean language was similar to Nahuatl the Aztec language spoken in the highlands of Mexico (Hewett, 1945). Further connections were made between native Plains people and the Tanoan and Aztec people (Hewett, 1945). It was discovered in the mid-1940s that five Pueblos in the upper region of the Rio Grande spoke Tewa, a dialect of the Tanoan language, and that this language was also related to dialects spoken by Jemez and Pecos people (Hewett, 1945). This linguistic overlapping provides an overview of where Native people were living in the Southwest and how they may have interacted with each other prior to the arrival of the Spanish. With this linguistic record, we can see the nomadic nature of many of the tribes around this time, showing that many tribes had not settled in one place at this point.

The archaeological record suggests that another big movement of people - Archaic people - into the Southwest happened around 5500 BC (Black, et al 2011), this could be when these languages met up in present-day New Mexico. These Archaic people arrived at the Rio Grande from the west around this time in coordination with an other climatic event that allowed them to remain hunter gatherers. The high temperatures that drove the bison from New Mexico cooled off from 5500 BC to 3500 BC which made hunting easier for these groups, a corresponding jump in population numbers at this time demonstrates the more available food supply (Black, et al 2011). By 3500 BC, this group developed extensive knowledge of plants, seeds, and farming, showing that agricultural practices among Native people goes back thousands of years (Black, et al 2011).

The movements of the Late Archaic people represent the second time humans reached the Rio Grande. The river was clearly an important part of the environment, and its existence made it possible for early nomadic people to hunt, farm, and survive in the Southwest. While there is not evidence of the river being altered in small or large-scale ways at this point in history, the Rio Grande and its tributaries continued to be a central part of Native existence.

### **Establishing the Rio Grande Valley:**

An excavation in 1917 identified 42 Pueblo ruins in the area from the Rio Grande to the Pecos River and from Santa Fe to Albuquerque. This excavation found small houses, evidence of temporary caves, rock shelters, and pictographs (Nelson, 1917). Artifacts found during this excavation put evidence of people in the area during the “pre-Pueblo” period.

This evidence of a more permanent existence again emphasizes the importance Native people placed on living along the Rio Grande and its tributaries. The excavation of small houses, shelters, and villages shows that the tribes were beginning to build more permanent structures and that the Rio Grande and its tributaries were a crucial part of making this lifestyle possible. The construction of houses and villages would put a greater strain on the environment by cutting down trees or utilizing plants for their houses and may be evidence of the first altering of the landscape along the Rio Grande by its residents.

In addition to the creation of more permanent housing structures, maize cultivation developed for the first time during this time period. In the Rio Grande Valley, the earliest evidence of maize being cultivated is between 1030 and 1170 BC in San Luiz de Cabezón and Jemez Cave (Vierra, 2007). Located in the Jemez Mountains west of Albuquerque, the Jemez Cave can still be seen from the Soda Dam waterfall. Rivers, hot springs, waterfalls, and high precipitation are witnessed in the Jemez region to this day. The high abundance of water must have played an essential role in the agricultural lives of these first settlers thousands of years ago and most likely played a large part in their decision to attempt crop growing in this area.

Additionally, there is evidence of high-water-table farming in Jemez around 1050 BC (Vierra, 2007). Around this time, Pueblo people along tributaries of the Rio Grande perfected using floodwaters and runoff. Rather than changing water flows, crops were only planted where tribes could take the most advantage of rainfall and runoff in watering crops (Black et al., 2011). This period when agriculture was becoming established allowed populations to grow large enough that foraging and hunting were not enough to sustain the community. The reliance on corn grew as the population did and tribes began focusing on storing enough grains and crops to feed them for years if necessary (Black et al., 2011). The increased populations facilitated by farming most likely put greater stresses on the water supply, and altering the soil for planting seeds most likely had some impact on the environment. Planting and storing crops and seeds and utilizing runoff are some of the first pieces of evidence of communities along the Rio Grande altering their environment. Still, these practices did not alter the flow of the Rio Grande instead relying on rainfall and the natural flow of the river most likely resulting in a temporary impact on the river and the environment.

Radiocarbon dating shows Native people who foraged in the Middle Rio Grande Valley migrated to higher ground during a drought that lasted from 250 - 500 AD (Vierra, 2007). At Nambe Falls and San Ildefonso, both areas at higher elevations than the archaeological record had previously seen, there is evidence of farming activity between 400 - 600 AD (Vierra, 2007). The need for



Native people to move to higher ground due to lack of water and the evidence of farming so early on suggests that the need for water to grow crops was already a significant part of Native life. In fact, this was so important entire tribes moved to follow the resources.<sup>2</sup>

An example of a group of people moving to follow resources is highlighted in an origin story from the Pueblo of San Ildefonso. This story shows how they arrived at the Rio Grande:

The ancient people of Galisteo had a snake, a big one and a black one, which they kept in the kiva. When they went hunting and got game of any kind, they fed it to him. Mule deer, buffalo, white-tailed deer, antelope, elk, rabbit, jackrabbit, birds - all these they fed him. In return he gave them anything that they wanted. Corn, squash, chokecherries, berries, yucca fruit, cactus fruit, Tewa berries, moccasins, leggings, deerskin shirts he gave them. One morning they went to look at him and did not find him. At midnight he had gone out. Nobody had seen him issue, nobody knew in which direction he had gone. They found tracks leading to the arroyo - big tracks, and they followed them. They followed his track along Galisteo creek, where he went along the bed. They followed them to the mouth, where the tracks went into the waters of the Rio Grande. They went back to their pueblo and they held a meeting that next night. And the old men said to the old men: "The snake has gone. What are we going to have of those things which he gave us? He has gone away. Now we also must be going away." And they all went down to Santo Domingo pueblo, where they settled. (Hewett, 1945)

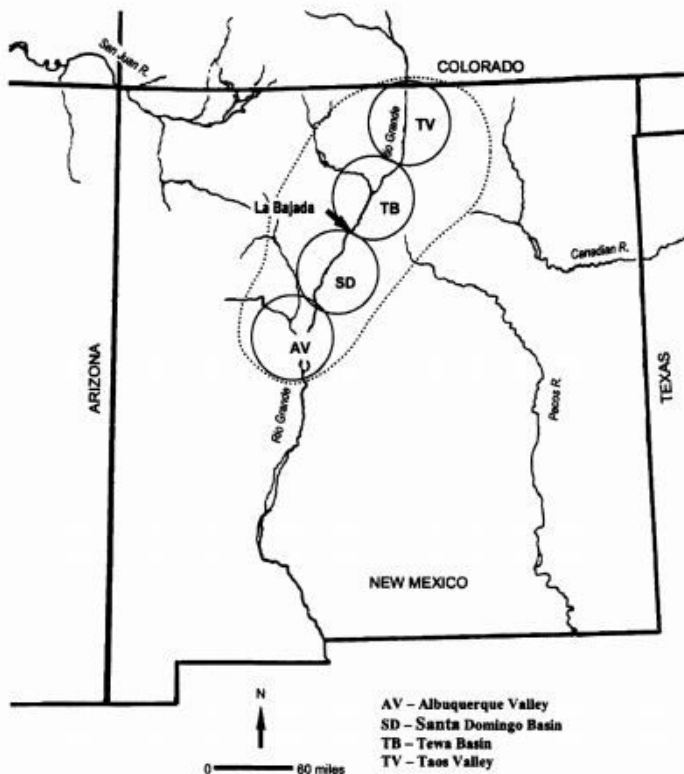
With depleted resources, the members of the community had no choice but to listen to what the natural world was telling them so that they could find a new area to live in where they could thrive. This story shows the importance of following the water and how important it was for the people to settle along the river.

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<sup>2</sup> Figure showing northern Rio Grande region, Lakatos, 2007.

Around 400 AD there is evidence of bows and arrows being used in the Chama area (Vierra, 2007), another tributary of the Rio Grande, again highlighting the migration of Native people. The archeological record jumps to 600 - 1200 AD when pottery is found in sites throughout New Mexico, most notably Albuquerque, southwest of Santa Fe, and along the Chama River (Wendorf, 1954). The development of pottery could point to an advancement in the storage of grains and crops for a long period of time, and highlights a more permanent existence in these areas. The ability and need to store food shows a focus on farming and an ability to grow enough to save for the future for a large community.

### The Three Sisters and Permanent Villages:



Historically, people living along the Rio Grande did not establish permanent villages much farther north than current day Taos or much further south than current day Elephant Butte (Riley, 1995). Between 600 and 900 AD there is little evidence of permanent structures in the northern Rio Grande area; circular pits representing residential units are found in some of the areas but that is all that is left of permanent structures from the time period in this area (Lakatos, 2007). More elaborate structures and rooms are not seen until 900 - 1200 AD in the upper Rio Grande Valley.

Archaeological evidence shows an increased dependence on agriculture, resulting in changes in diet, and a decrease in infant mortality in the Rio Grande Valley between 600 - 900 AD (Vierra, 2007). By about 1000 AD permanent villages were established in the region, crops such as

maize, squash, and beans were harvested, and trade with tribes in present-day Mexico was established. Depending on the strain, maize can take 60 to 100 days to fully mature (Albert, 2009). Planting, cultivating, and harvesting maize would be a large commitment for a previously nomadic people. This evidence from around 1000 AD shows not only a change in lifestyle for the Pueblo people of present-day New Mexico, but a new willingness, ability, and desire to alter their environment. Cultivating crops undoubtedly put a higher demand on water sources, and could provide further evidence of Native people utilizing the river in new ways.

Native tribes refer to corn, squash, and beans as the “Three Sisters” due to the fact that these crops support each other by providing different nutrients to the soil so each crop can continue to grow year after year (Bandelier National Monument, n.d.). They also provide excellent sources of nutrition for the people who harvest them (Indian Pueblo Cultural Center, n.d.) and continue to be an essential part of the Native diet to this day.



Growing crops was not the only way the Native people at this time impacted their environment. They were also establishing villages in concurrence with the development of agriculture. Excavation of sites from this period show a variety of communities with some pueblos containing just ten to twelve rooms but some containing one hundred rooms (Wendorf, 1954). The larger sites could contain up to four kivas (Wendorf, 1954), round rooms

built into the ground used for religious purposes. Artifacts at these sites include turquoise beads,

plain pottery, and axes (Wendorf, 1954).<sup>3</sup> These communities and artifacts are further evidence of a movement away from a nomadic lifestyle.

Excavations at Bandelier National Monument in the early 1900s show some ingenious uses of water irrigation. One technique was the development of grid gardens, also called waffle gardens, due to their square shapes. Grid gardens (left next page at Bandelier National Monument) were constructed by making small depressions in the ground and building a rock wall or bricks made from the earth around them to catch rainwater (Bandelier National Monument, n.d.). Evidence of “waffle gardens” also exists at the Zuni Pueblo (Indian Pueblo Cultural Center, n.d.). The soil in the area had a high concentration of pumice which was used extensively in the fields as the rock



acts like a sponge and would release water over time to provide moisture for the soil (Bandelier National Monument, n.d.).

The development of these villages and kivas called for the use of wood and various

other vegetation available to villagers to build homes and fires (Riley, 1995). Along the Rio Grande, Native people would use willows from Yucca plants to weave baskets and create paintbrushes (Indian Pueblo Cultural Center, n.d.).

Before the arrival of the Spanish, the Pueblo people had to carry the wood themselves as modern horses were not known in North America, which could explain why many villages were abandoned after 50 to 100 years. When the supplies of wood and timber in the area were decimated, carrying materials became too much of a burden to the people and it was time to find a new place to establish villages (Riley, 1995).

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<sup>3</sup> Picture of Kiva taken at Salinas Pueblo ruins by author.

This evidence of moving because of depleted resources by early Native tribes further emphasizes the impact they were having on their environment. The cutting of timber and stripping of vegetation may seem like a modern development, but clearly these practices were happening well before the arrival of the Spanish. Although the depletion of resources sometimes got so serious tribes were forced to move, this still happened on a small environmental scale. Additionally, while the cultivation of crops put a greater strain on the water supply, the utilization of waffle gardens and pumice shows that tribes were not altering the river, but were relying on rainwater and soil management to manage their farms. Native tribes were working within their natural environment and the impact they had through agriculture and building permanent structures did not lead to long-lasting or irreversible damage.

Between about 1000 - 1200 AD foraging groups in the northern part of the Rio Grande Valley disappeared. This is either evidence of these groups establishing farming practices, being forced out of this area, or being absorbed into other groups (Vierra, 2007). The archaeological record shows that some of these villagers fled to the Rio Grande Valley circa 1250 AD (Bahti, 1997) as they were driven from their homes by the ancestors of the Navajo and Apache people. These migrations of the late 1200s were likely caused by a major drought that occurred at this time. The drought probably exacerbated the raids by Navajo and Apache tribes as they also looked for more resources. This drought caused a large abandonment of the San Juan valley, which suggests these agriculturalists depended greatly on crop growing. Without enough water communities could not sustain themselves in the region (Black et al, 2011).

Additionally, in Rinconada Canyon, on the outskirts of modern-day Albuquerque, petroglyphs provide evidence of a dramatic increase in population and the establishment of villages along the Rio Grande around 1300 AD (National Park Service, n.d.). With an increased focus on crop growing, populations were able to greatly expand. However, with farming sustaining larger populations, changes in water availability or temperature had a more drastic effect on a larger number of people. With the settling and resettling of different parts of the Rio Grande Valley,

there is a boom and bust cycle that allowed populations to grow then decrease based on environmental factors. This cycle shows that Native groups were able to use their environment to feed larger and larger groups of people, but were still at the mercy of natural fluctuations of resources.

The disappearance of foraging groups, the establishment of farming practices, the need to move due to drought, and the development of pottery all point to an abandonment of a full-time nomadic lifestyle. With the establishment of more permanent farms and homes, Native people had an increased dependence on the river and the need for reliable water sources. Nomadic people could follow resources as they moved, but between 1000 - 1250 AD tribes resettled due to lack of water with priority placed on locations where permanent dwellings and reliable water sources could be established. By the 1400s, tribes no longer spread out throughout the entire Rio Grande region but concentrated downhill of the mountain regions due to lack of resources for expanding populations (Black et al, 2011).

This altering of the landscape increased further after 1400 AD as even larger villages were established which led to increased “human-environment interactions” (Jones, 2015). This implies that with the establishment of larger villages humans had a great impact on their environment. Additionally, trade occurred between the people of the Rio Grande Valley and other regions of the Southwest, so non-endemic species such as turkeys were introduced to the area (Jones, 2015), further impacting the landscape. There is evidence of erosion happening around this time period due to the cutting down of timber for firewood and building material which led to some flooding along the bosque (the Spanish word for forest), but large-scale destruction of the environment was minimal as grazing animals were not present and populations were still relatively low (Riley, 1995). Ample evidence from this time period shows Native groups utilizing and altering the Rio Grande and its tributaries which changed the landscape. However, the river was never “controlled” and the changes generally lasted for short amounts of time (Black et al., 2011).

Archaeological evidence shows that large villages were established along the Rio Grande around 1400 AD. However, there is evidence that other groups moved to the Rio Grande Valley and possibly merged with other tribes who were establishing agriculture along the river and shared the farming knowledge they had with each other. Either way, this constant migration of new groups into the Rio Grande Valley shows the need for tribes to construct their villages along the banks of the river to sustain their agricultural practices.

At this point the Rio Grande, Rio San Jose, Jemez River, Rio Puerco, Rio Chama, Zuni River, Rio Pescado, and other tributaries housed thirty villages (Black et al., 2011). Tiguex, representing current-day Albuquerque, had twelve villages most likely including Isleta and Sandia which remain today (Wendorf, 1954). The population would continue to grow along these waterways until the arrival of the Spanish in another 150 years (Black et al., 2011). Around 1540 the Spanish would note an additional seven pueblos to the east of the Sandia Mountains, another seven in Jemez, as well as several other Pueblos that the Spanish knew of but are now lost to history (Wendorf, 1954).

### **The Arrival of the Spanish:**

By the time the Spanish entered New Mexico, these large villages had existed for 300 to 400 years (Riley. 1995). Before Spanish arrival in New Mexico, an estimated 100 pueblos were found along the Rio Grande Valley and beyond. Spanish estimates of the population when they arrived ranged anywhere from 20,000 to 130,000, excluding nomadic people outside of the villages (New Mexico History Museum exhibit, n.d.).

In *Conflict on the Rio Grande: Water and the Law 1879 - 1939* Douglas Littlefield explains:

“The Pueblo Indians have, since long before the coming of the Spanish, occupied the approximate present sites of their villages except when they were forced from them at the point of the sword or because of devastations by fire or flood or the failure of the water supply. Archaeological remains along the Pajarito Plateau reveal that the Indian homes

hugs the diminishing water supply of the springs in ever-narrowing circles before the people moved into the valley to take advantage of the life-giving water of the river. There the Spanish, upon their arrival, found extensive and ingeniously developed Indian irrigation systems already in existence.”

Spanish records corroborate that Native people were establishing their villages along the river because they were using it to make agriculture possible. This passage also explains that irrigation systems were common, a major way of altering the behavior of the river. Additionally, Spanish witnesses noted that Native people valued and utilized the water so much that they frequently uprooted themselves to find more favorable locations with more dependable water sources.

The established tribes the Spanish encountered and their locations along major waterways, emphasize the importance of the river in everyday Native life for a wide variety of pueblos. By the time the Spanish arrived, Native people had been settling and resettling in the Middle Rio Grande Valley for centuries. Spanish witnesses confirm complicated irrigation systems and permanent structures, and the control of water to some degree by almost every tribe (Black et al., 2011). The written record provided by the Spanish emphasizes that Native groups were utilizing their environment in ingenious and complicated ways but they were not controlling the river or nature in a large-scale way. Constant migrations again show that nature dictated where life was possible for Native groups - not vice versa.

It is important to note that at this time the river was able to sustain these large populations despite the widespread utilization of irrigation for farming and the construction of permanent structures - sometimes even when these structures were so numerous they ended up creating large villages. So while agriculture, permanent structures, and irrigation were well established by the mid-1500s, the human impact was not so extensive as to cause damage to the Rio Grande or irreversible changes to the environment.



In addition to a growing population, the Spanish found a wild Rio Grande that flooded every spring when the snow from the mountains melted. This swelling of the river was so intense some years that the river would change course (Black et al, 2011). Unlike today's river, many parts had swamplands filled with aquatic grass, willows, and cottonwoods, and the waterways teemed with twenty-four species of fish (Black et al, 2011). Whooping cranes, jaguars, beaver, and other large birds and rodents were also supported by the river (Black et al, 2011).

According to an exhaustive environmental study on the Rio Grande Valley conducted by the United States Fish and Wildlife Service, New Mexico was experiencing a "Little Ice Age" when the Spanish arrived. This climate event began around 1430 AD (Scurlock, 1998) and lasted until the mid 1800s. This period saw temperatures 1.8 degrees to 3.6 F degrees below average for the time and led to increased moisture in the area which mostly benefited the Pueblo people (Scurlock, 1998). Snowpack runoff benefited farming but also led to floods which caused some villages to be abandoned for higher ground (Scurlock, 1998).

Even during this "Little Ice Age" droughts occurred, and the Spanish and Native people often had to contend with either too much water or too little. Between 1550 and 1650 an estimated twenty to fifty Pueblos were abandoned, mostly on the southern Rio Grande, the Galisteo and Estancia Basins, the Middle Rio Grande, and Jemez (Schroeder, 1979). Some of this migration was no doubt necessary because of drought and flooding, which shows how integral farming and irrigation had become by this time for Native people. The amount of water dictated life for almost every Pueblo in the Rio Grande Valley, and the tribes so depended on harvesting crops that a change in available water forced them to relocate. The need to migrate due to flooding and drought also shows that Native groups and Spanish settlers had only minimal control of the Rio Grande and its tributaries. Native groups had been practicing irrigation in the valley for hundreds of years, but they still needed to relocate when nature dictated. Their inability to control the river shows that their impacts were minimal and short-lived.

Heavy snowfall occurred in 1540 in the present-day Bernalillo County area and the Rio Grande froze in winter and did not melt until May (Scurlock, 1998). These heavy snows caused severe flooding throughout the region, and it is estimated that Santo Domingo Pueblo flooded in 1591. However, these wet years were followed by drought which were hard on both the Spanish and Pueblo people. The cycle of floods followed by drought was repeated until the mid-1850s.

Native movements occurring during this time period coincide with the arrival of the Spanish, and natural river fluctuations. The abandonment of multiple villages and sites by the Pueblo people throughout the mid 1600s can be attributed to the worsening of the drought. The drought made it hard to farm and also led to increased raids by the plains Apache people - further changing the location of many tribes. The impact of these droughts is estimated to have caused the population of the Native people to drop from 40,000 in 1638 to 17,000 in 1671 (Scurlock, 1998).

Droughts had a severe impact on the residents of the Rio Grande Valley and out on the plains. If the residents of the Pueblos had the ability to store water for long periods of time, droughts might not have led to such frequent migrations and would not likely have had such a drastic impact on these populations. Unlike today, it seems obvious that Native tribes and the Spanish did not have dams that could alleviate their need to follow water sources as they moved. The ability to dam and store water would have undoubtedly made life easier, but would also have had a much more long-lasting impact on the river and the environment in the valley.

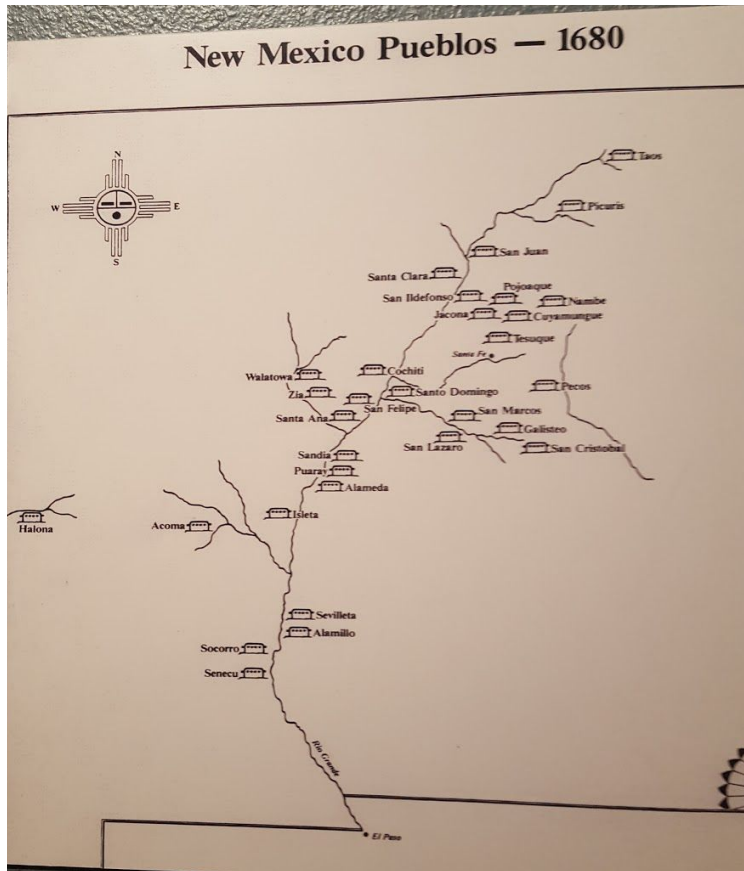
With the arrival of the Spanish, irrigation and water management became more complicated. In addition to the irrigation they witnessed the Native tribes conducting, the Spanish also brought their own heritage of irrigation. “Acequias” or Spanish irrigation canals were built in the upper portion of the Rio Grande. These canals diverted water from the Rio Grande and its tributaries so the Spanish could grow and water their crops, as well as control stream flows (Black et al, 2011). These irrigation canals, first built in the late 1500s, are still utilized throughout New Mexico.

When the Spanish arrived in present-day New Mexico, they pushed their religion on the tribes, trying to spread Catholicism and suppress Native traditions. As the drought continued into the mid-1600s, the practice of pushing Catholicism onto the Pueblo people - while also suppressing traditional Native religious activities - continued. The Spanish found a growing society when they arrived in New Mexico in the 1500s, but under their rule the number of pueblos shrank from 66 in 1540 to just 19 in 1700. The Native population was cut in half (Bahti, 1997). The worsening drought and the treatment of the Native people by the Spanish are two main factors contributing to the Pueblo Revolt of 1680, a successful coordinated uprising of Pueblos against their Spanish colonizers. The Native people of New Mexico are the only people to have successfully driven out Europeans in the history of the United States.

In an effort to spread Catholicism throughout the Southwest, the Spanish would construct missions - or small churches - throughout the villages of the land. They forbade traditional dances and other ceremonial rituals the Native people had been practicing their entire existence. The combination of this suppression of their identity as well as the decades long drought came to a head in 1675 when the Spanish convicted 47 Puebloan caciques - or priests - of sorcery and plotting to rebel against the Spanish. Four of those convicted were hanged until dead, while the rest were whipped and released (Torrez, n.d.).

One of the released religious leaders was Popay from San Juan Pueblo, who would go on to become one of the central figures of the Pueblo Revolt. After his release, he spent years organizing Pueblos throughout the region to revolt against the Spanish. During his travels to the various Pueblos he encouraged the Native populations to reject the Spanish influences and return to their cultural practices, presumably some of which had been lost for a number of generations (Liebmann, 2007).

On August 10, 1680 tribes from across the region worked together, perhaps for the first time, from Taos Pueblo in the north to the Hopi in the east and the Apache in the west to fight the Spanish and drive them from the land. The missions put up by the Spanish were burned to the



ground and the priests and nearby Spanish settlers were murdered (Torrez, n.d.). After this was accomplished the Pueblo people met in Santa Fe, established as the Spanish capital in 1610.

On August 15th the siege of Santa Fe began (New Mexico History Museum exhibit, n.d.) which ended on August 21st when the Spanish retreated down the Rio Grande towards El Paso. The Spanish did not return until 1692, when Diego de Vargas reoccupied Santa Fe.<sup>4</sup>

The Pueblo Revolt highlights the importance of a healthy environment on the

Native people. While their treatment under the Spanish was a major driving force of the revolt, the importance of the drought cannot be overstated. With their dependence on irrigation and farming for hundreds of years at the time of the Revolt, the drought had devastating effects on the Native populations and their way of life. If agriculture and irrigation had not been such an integral part of their lives and survival when the Spanish arrived, these encounters might have turned out very differently, and the drought might not have had such a crushing impact on the villages of the Native people.

During the period when the Spanish were driven out of New Mexico, there is evidence that Popay's cry to return to cultural traditions happened in northern New Mexico (Liebmann, 2007). Architecture from this time supports the idea that many Pueblos returned to a more traditional style of home building. Pueblos continued to reject Spanish rule by abandoning mission pueblos

<sup>4</sup> Photograph taken at Indian Pueblo Cultural Center, Pueblos as of 1680.

at Cochiti, Santo Domingo, and Jemez and building new villages on nearby mesas (Liebmann, 2007).

While declining populations and the return to traditionalism most likely had some impact on the movement of Native people from certain locations, migrations continued to occur as they did before the arrival of the Spanish (Kulisheck, 2003). The arrival of the Spanish altered Native life forever, but this did not stop from continuing their agricultural practices and the need to move to make farming possible as the environment changed (Cameron, 1995). Evidence of continued movement based on available water supplies and the need to farm - even in the face of a conquering nation - suggests a strong dependence on the Rio Grande and its tributaries to make life possible for various tribes. When the ability to farm was no longer possible, there is evidence time and again of Native migrations to more suitable farming locations. Constant migrations once again show that Native tribes and Spanish settlers needed to move as their environment changed, evidence that their control of the land and water was minimal and impermanent.

During this time, excluding the twelve years when they were driven from present-day New Mexico, the Spanish continued to practice their own farming and irrigation techniques. Studies estimate that between 1590 and 1846 Spanish settlers built four hundred irrigation ditches in the upper portion of the Rio Grande Valley. These acequias were able to irrigate an estimated 55,000 acres or about 130 acres per community (Black et al, 2011). While the acequias allowed the Spanish to divert a large amount of water, there were no dams so water was not stored and a great dependence was placed on snowmelt and summer monsoons (Black et al, 2011).

Spanish technology was simple but effective. It allowed settlers to utilize the river to grow their crops and establish villages in the upper region of the Rio Grande. By relying on snowmelt and rain and not storing water in dams the impact the Spanish were having on the river was limited, much like the Native impact. With the arrival of the acequias to the Rio Grande, the river continues to be utilized in new ways to make agriculture possible, but even these new practices still allowed the river to be wild and human impact to remain at a minimum.

Acequias were a central part of life for the Spanish from their arrival in New Mexico through the 19th century. One riddle highlights the importance the river played on life: *¿En que es suspendido el mundo? En la voluntad de Dios. ¿En que es suspendido nuestro pueblo? En el rio.* The riddle asks how the world was hung in the universe and how the village was supported. The answers are by God's will and by the river, respectively (Black et al, 2011). This common riddle asked throughout the Rio Grande Valley emphasizes that the river is almost as important, if not as important, as the will of God. Without the river the community would not be able to thrive.

### **United States Control and Statehood:**

The Spanish and Native people continued to use acequias and irrigation technology as they had for hundreds of years up to the late 1800s. The Spanish and Native tribes even shared acequias in some instances. For people living along the Rio Grande, those in the middle region of the valley often had to contend with overflows from snow melt and were often forced to rebuild their diversion systems (Black et al, 2011). In the summer, residents along the river had to deal with drought due to lack of rainfall. Residents along the river until the mid-1800s simply lived with this reality and did not attempt to alter the river's course despite the constant fluctuation in water availability (Black et al, 2011).

In 1848, the history of New Mexico was forever altered with the signing of the Treaty of Guadalupe Hidalgo which transferred parts or all of present-day California, Arizona, Utah, Colorado, and New Mexico from Mexican ownership to the United States. This treaty also set the Rio Grande as the border between the US and Mexico (Bowden, 1959).

Now a territory of the United States, New Mexico became susceptible to United States laws and goals. In 1878 railroads were built connecting New Mexico with the rest of the Southwest (Black et al, 2011) as well as Washington, DC to the east. The construction of the railroad required large-scale timber cutting in the north, which served as the headwaters for the Rio Grande; this

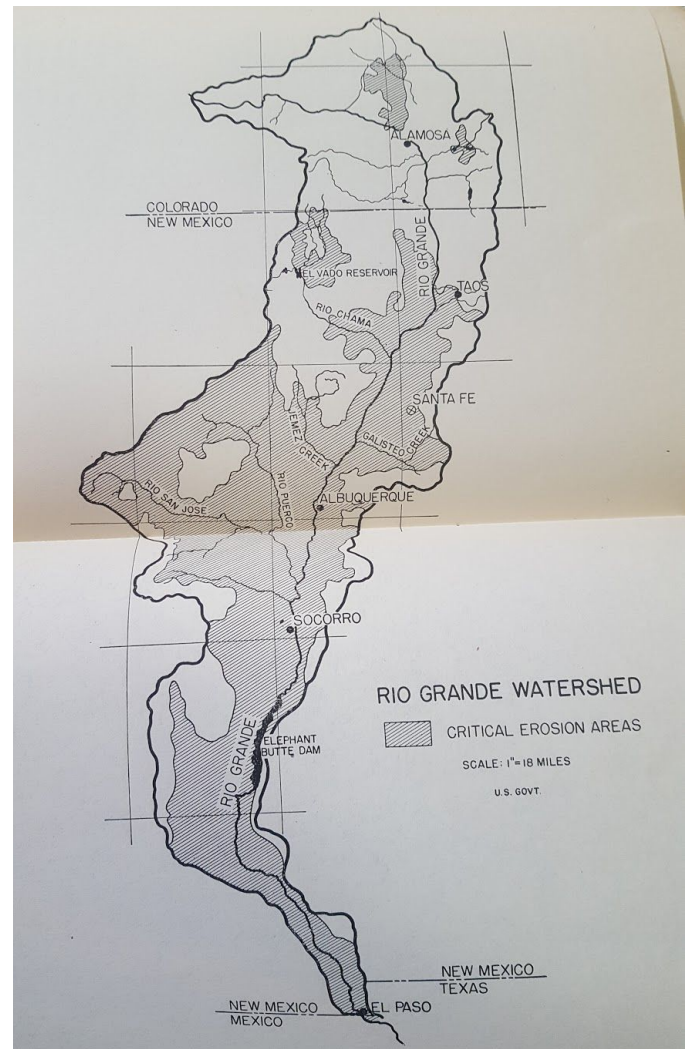
destruction of the forest led to erosion and changed the flow of the river forever (Black et al, 2011).

The coming of the railroads made travel to New Mexico easier, which led to an influx of new visitors and residents from the east. This growing population led to a stretching of the already limited resources.

In 1912 New Mexico became a state, bringing additional changes for the people living there. Soon after statehood, engineers began seeing the oscillation between floods and drought along the Rio Grande as a problem that could be fixed through technology. Given the rise in visitors and population, the need for reliable water sources increased.<sup>5</sup>

### **Modern Water Management and Current Threats:**

The Middle Rio Grande Conservancy District was created in 1923 to provide flood protection to the inhabitants along the Rio Grande. The area covers 150 miles from White Rock Canyon to the village of San Antonio (Nickerson, 1945) and in 1945 aimed to control irrigation and flooding on 150,000 acres of land along the river. At the time, half of the land was being cultivated for subsistence farming. The United States government and engineers saw potential for increased resource management in New Mexico and the need to better control water resources.



<sup>5</sup> Rio Grande watershed, Nickerson, 1945.

A report from 1945 states: “Although this area is extremely rich in certain of these resources, some of them have been only meagerly developed to date... In the semi-arid Rio Grande Basin the waters of this river must be controlled, conserved, and used to the fullest possible extent both for the development of agriculture and water power (Nickerson, 1945).” This passage clearly indicates that utilizing what nature provided would no longer suffice. Resources would need to be developed further and water would be used on a large scale for farming and to meet the energy needs of the region’s growing population.

While flooding continued to occur in the spring with the melting of the mountain snowpack, erosion, agriculture, and the amount of people in the area conversely contributed to lack of a reliable water source. Many of the current issues facing the Middle Rio Grande Valley were identified in 1945, “There are indications from all quarters that the seriousness of the watershed problem facing the Rio Grande Valley is not fully appreciated by the residents of New Mexico. The continued use of the valley for agricultural and stock raising purposes, and even for mere habitation, is gravely endangered if conditions on the watershed above the valley continue to accelerate the processes of erosion (Nickerson, 1945).” Today, agriculture and a growing population remain some of the major threats to the Rio Grande.

Throughout pre-Spanish settlement of the region, and through the Spanish years, the Rio Grande was utilized but never altered permanently. It was never controlled or redirected on a large scale. If flooding or droughts were severe enough, Native tribes would move to more suitable locations to set up villages. Residents who depended on acequias simply took the flooding and droughts as part of nature and did not see the seasonal changes as something they could control. The construction of dams forever changed this as it aimed to control the actual flow and nature of the Rio Grande.

Beginning in the early 1900s, engineers were eager to fix the water issues of the Southwest through the use of technology. Storing water so the residents of the Middle Rio Grande Valley could have a reliable water source all year long, without worrying about flooding or drought,



must have seemed like a miracle to some residents in the valley. However, all residents currently living along the Rio Grande are now living with the repercussions. Overmanagement of the river has reduced its flow, led to contamination of the drinking water supply, caused the extinction of native plants and introduction of nonnative species to such a degree that the river is now fundamentally different. The building of the dams has had a disproportionate affect on the way of life of Pueblo people, who lived in the region for thousands of years without the assistance of dams.

The repercussions of dam building is perhaps most obvious at Cochiti Pueblo which is home to Cochiti Dam, the dam that controls the water of the Rio Grande from north of Albuquerque south to Elephant Butte. The people of Cochiti have lived on their Pueblo - in the same location they are in today - for at least seven hundred years (Black et al, 2011). Oral tradition says the Cochiti people arrived at their present day Pueblo from the west and brought water practices with them that included diverting water to a floodplain for their fields and were able to store small amounts of water in low-constructed dams (Black et al, 2011). Traditionally, the river was unpredictable and the people of Cochiti worked as much as they could within this unpredictable landscape, sometimes planting corn in the middle of the river on islands that would occasionally develop (Black et al, 2011).

With this long tradition of farming on their land, the people of Cochiti opposed the building of the dam from the beginning. It was built anyway between 1965 and 1975. In the process the US Army Corps of Engineers flooded sacred sites and fields that had provided the Cochiti people with crops for centuries (Paskus, 2013). At a symposium held in April of 2006, Regis Pecos from Cochiti Pueblo explained the impact the dam has had on his people who refer to the building of the dam as “their nightmare” (Natural Resources Journal, 2006).

The building of the dam at Cochiti destroyed available agricultural lands, destroyed traditional summer homes, altered the landscape, and destroyed places of worship. The impact of the dam on the Pueblo did not end when the dam was finished however. After finishing Cochiti dam, a

leak flooded the remaining agricultural lands turning them into a wetland. This forever altered the lives of the Cochiti people (Natural Resources Journal, 2006).

The tragic consequences of Cochiti Pueblo highlights the destruction dams brought to just one section of the Rio Grande. Prior to the construction of the dam, the people of Cochiti - as well as Spanish settlers and other Native tribes - had utilized the river and water sources in a way that was sustainable for generations. While the flooding and drought periods were unpredictable and could lead to migrations and tension between communities, life along the river was manageable and agriculture was able to sustain entire communities. Dam construction not only changed the way of life for almost every tribe in the Rio Grande Valley, but it also forever altered the ecosystem and flow of the river.

Between Cochiti Dam and Elephant Butte Dam the water of the Rio Grande is controlled by the Middle Rio Grande Conservancy District. This agency bases water flow on the needs of agriculture, the cities along the river's banks, and the needs of the silvery minnow - an endemic species of fish listed as endangered and under the protection of the Endangered Species Act (Paskus, 2013).

In an interview with John Fleck, longtime journalist at the Albuquerque Journal, Fleck discussed how much of today's water management is dependent on the needs of the silvery minnow. Ironically, the traditional habitat of the silvery minnow was greatly diminished by the construction of the dams. According to Fleck, the silvery minnow traditionally had a flexible range where they moved into different streams and tributaries along the Rio Grande depending on the season. After the building of the dams, the silvery minnow went extinct north and south of the dams, and is now trapped in between Cochiti and Elephant Butte. Since the minnow's addition to the endangered species list, the dam that destroyed the minnow's traditional range now dictates the amount of water flowing in the Rio Grande to save it.

The silvery minnow is not the only fish to experience the downside of dam building along the river. Today, there are fourteen endemic species of fish found in the Rio Grande, reduced from an estimated historic number of twenty-four (Sallenave, 2015). The introduction of invasive species - both by humans and by a changing climate - has put further pressure on the river. One invasive species, the Russian Olive, is found all along the banks of the Rio Grande and has had a profound impact on the landscape. Soil found around Russian Olives has increased levels of nitrogen compared to native plants, and the Russian Olive is outcompeting native plants such as cottonwoods (DeCant, 2008). This is just one example. The introduction of nonnative fish to the Rio Grande is having a profound effect on the state fish - the Rio Grande cutthroat trout. Only a few years ago, the Rio Grande cutthroat trout was on the endangered species list and one of the main threats to its survival was hybridization with nonnative fish (USFWS, n.d.). Low water levels continue to impact the fish left in the Rio Grande - fish kills and salinization have been reported along the Texas portion of the river (WWF, n.d.).

Dams are not the only way human technology and interference have damaged the Rio Grande and hurt the original inhabitants of the area in the process. Industry, agriculture, and waste have also caused great damage to the river. For years the city of Albuquerque dumped millions of gallons of wastewater into the Rio Grande - just upstream of the Pueblo of Isleta. In addition to high levels of arsenic and ammonia, it is estimated the city dumped 55 million gallons of wastewater into the river a day (Lenderman, 1998).

In an interview with Ted Jojola, current Indigenous Design and Planning Institute Director at the University of New Mexico and member of Isleta Pueblo, he said he alerted then-governor of Isleta Verna Williamson to the water quality crises in the mid-1990s. He happened to stop by a science fair in the city of Socorro and asked one of the students about their findings about the quality of the Rio Grande. The student had discovered that contaminants in the river were “off the charts” and many parts of the river were essentially an “aquatic deadzone.” This was a result of the wastewater treatment plant in Albuquerque and was impacting the water of Isleta. The

discovery of the poor quality of the water coincided with a number of people at Isleta getting sick after a ceremony that involved drinking water from the river.

Isleta took action by establishing a water-quality standards program and meeting with the city of Albuquerque to get the quality of the Rio Grande up to their standards. Initial meetings with the city went well, but in 1992 Albuquerque sued the Environmental Protection Agency saying the city should not be held responsible for the clean up since the pollution was coming from industries upstream (Lenderman, 1998). The city also claimed that the water quality standards established by Isleta Pueblo were not based on “science” because the standards required the water be healthy enough to perform religious ceremonies. Jojola said the city claimed these standards were too “esoteric.”

In a groundbreaking decision, the Supreme Court ruled against the city of Albuquerque - a huge win for Isleta and tribal water rights (Lenderman, 1998). The city of Albuquerque was forced to update the wastewater treatment plant.

Unlike agricultural practices of the original Native tribes and Spanish settlers, today’s agricultural practices are another huge threat to the health of the Rio Grande. With the Southwest facing years of crippling drought, large-scale extraction to meet agricultural needs continues to pose a threat to the river (WWF, n.d.). Despite the fact that water extraction went down in 2005 from 1999 levels, low snowpacks and continued drought remain a serious concern (WWF, n.d.). Despite the new wastewater plant in Albuquerque, pollution continues to plague the Rio Grande all along its course (WWF, n.d.).

### **Conclusion:**

For many years conservation focused on the setting aside of land or water for no human to use or touch. Despite the establishment of wilderness areas, parks, and game preserves, biodiversity continues to decline (Kareiva et al., 2012). Many in the conservation movement forgot that humans are part of the environment and have always had an impact on our ecosystems. The

acknowledgement that humans have a profound impact on our ecosystems and that it is nearly impossible to recognize what many ecosystems could have looked like in early iterations has driven some ecologists to invent new words to define our natural world (Morse et al, 2014).

We have some idea of what a wild Rio Grande used to look like, but we will never know the full extent human intervention has had on the river. A completely unaltered Rio Grande is impossible to return to, and would not necessarily give the residents who live there today the result they want. Humans have altered and tended to the Rio Grande and its banks for thousands of years. By diverting rainfall, creating irrigation canals, and planting crops along the floodplain, humans had an impact on the environment and the nature of the river. This altering made life possible for the small communities who lived along it, while the river was allowed to continue to change and flow as nature dictated.

While humans have always altered the landscape and the Rio Grande, it is only in fairly recent human history that the river has been changed irreversibly. This interference has resulted in the Rio Grande being reduced to a trickle throughout the Southwest. Today's residents of the Rio Grande Valley should not be afraid to use the river, but should look to do so in a sustainable way. By looking to our past it might be possible to learn how to use the river in a sustainable way moving forward.

As climate change continues to result in a hotter and drier world, and residents of the Rio Grande Valley face more serious water shortages, creative solutions will be needed. As the original inhabitants of the region showed us, it will take a hands-on approach for life to continue to be possible in the Southwest.

The West and the Rio Grande are an almost mythical part of American culture. Countless movies, songs, and stories focus on the Southwest and life in this region has shaped how Americans view ourselves for the past one hundred years.

A poem from 1910 highlights the importance and history of the Rio Grande:

Onward rolls the Rio Grande  
Sweeping proudly to the sea,  
Dreaming oft, yet slumbering never  
Clothed in sunshine and mystery.

Speak and tell thy tales, O river!  
Tell thy story now I pray,  
Whisper me some golden legends  
From thy realms of yesterday.

I heard thy ripples murmur  
Ghostly songs in rhythmic flow -  
As old faces drifted seaward  
In the far-off long ago.

Thou hast seen the high mountain snowfall  
And heard the lonely seabird cries  
Long before the birth of Moses  
You have blessed the Gulf Coast skies.

You are the life blood to so many  
You are a legend to us all!  
Oh you mighty RIO GRANDE  
Flowing to the Gulf.

Over one hundred years ago the anonymous author of this poem knew that the Rio Grande had a rich history, provided life for the region, and flowed more wild than it does today. Soon after the

writing of this poem the Rio Grande was tamed by dams, and today it no longer “sweeps proudly to the sea” but rather struggles to get there on many occasions.

Human engineering has provided great advances in many instances but in the case of the Rio Grande, humans have used technology to put too much pressure on an already limited resource. Through the history of the Native people and the Spanish settlers we see an example of how to use nature without forever damaging it for following generations.

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