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| PROJECT TITLE:                                        |                                                      |
| <b>Legacy of Irrigation In the American Southwest</b> |                                                      |
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### **SCHOLARSHIP & RESEARCH**

#### **1. Primary Investigative Question(s) –**

How did the irrigation methods practiced by the Hohokam, Spanish colonizers, and the U.S. government in the American Southwest progress over time? How do these methods represent a global convergence of technology? What are the lasting impacts of irrigation in regards to population and settlement?

#### **2. Contextual Essay –**

##### **The Irrigation Legacy of the American Southwest**

“Water is the basis of life and the blue arteries of the earth! Everything in the non-marine environment depends on freshwater to survive.”

*Sandra Postel, Global Water Policy Project*

Water is the foundation of life. The availability of freshwater should be the first consideration when settling an area. Whether this settlement is permanent or temporary, its success depends upon a consistent and reliable source of freshwater. A positive correlation exists between population and the need for water. As population expands so too does the amount of water needed for the population’s survival. By nature some areas are better suited to meet the realities of this relationship. Those areas not bequeathed by nature with adequate stores of freshwater must modify the landscape or face peril.

The ability to irrigate land is paramount to settling in arid locations. A lack of consistent water hinders agricultural endeavors, limits population growth, and stifles cultural development. To this end, groups have been practicing irrigation, or the diversion of water for agricultural and habitation purposes since the ancient Sumerians of Mesopotamia. One region that demonstrates the need for irrigation is the American Southwest. The settlement of the Southwest offers a glimpse of the interplay between history and geography. For centuries, the

inhabitants of this arid landscape have been diverting water to ensure not only their survival but the region's survival as a place worthy of settlement.

The study of geography is not limited to answering where places are located. One of the primary undertakings of geographers is to examine the effect people have on the land they inhabit and conversely the effect the land has on those who dwell there. As one of the five underlying themes of geographic inquiry, human-environmental interaction seems slighted in a constant push to stress location and mapping skills. Irrigation provides the geographer a lens through which to view the theme of human-environment interaction, both its benefits to the inhabitants and its impact on the surrounding land. This process of bringing water to dry areas typifies the modifications humans must make to survive in harsh climates and the lasting implications of those modifications.

Having been under the control of many groups of varying ethnic heritage and technological skill-sets the American Southwest serves as an exemplary case study for irrigation. To all who settled in the desert climates of present day Arizona, New Mexico and Nevada, procurement of fresh water was vital for survival. The harsh arid and semiarid geography of this area did not, however, provide that water liberally. The residents of this region had to adapt their lifestyles to capitalize on the scarce amount of precipitation. They did this through varying complexities of irrigation systems which eventually led to the permanent settlement of the American Southwest.

While several groups, both historic and modern, developed irrigation systems in the Southwest, three groups effectively demonstrate the evolutionary scale and scope of this undertaking. These groups, the indigenous Hohokam, Spanish colonizers, and the United States government, all developed methods of irrigation suitable to the dry climate of the Southwest and amenable to their populations. Spanning close to two millennia, the land modification practices of these divergent people provide ample evidence of the legacy of irrigation in the Southwest and its impact on American westward expansion. Also evident is the influence of global understandings of water diversion.

Before one looks at the historical pattern of irrigation in the American Southwest, a brief examination of the climate of the region is in order. Arid climates are defined as receiving less than ten inches of rain per annum. A quick survey of climate records for this region, including the modern cities of Phoenix, Arizona and Santa Fe, New Mexico, demonstrates its arid nature. While climatic change can occur over time, scientific evidence shows the aridity of this region over its history. Therefore, once the decision was made to settle this region, contingencies for a steady supply of water became necessary.

The first group of people worth examining is the Hohokam. The Hohokam were a group of desert dwelling people who settled in the Southwest around the First Century C.E. Historians suggest that by the Ninth Century they had established a civilization rivaling that of the Aztecs and Mayans to the south. (Reisner, 1986, p. 265) During the height of their civilization they built houses and fashioned pottery and engaged in sport. That an ancient group of people could establish a cultured foothold in such a foreboding land is a testament to their ingenuity. They put that ingenuity into practice with their irrigation methods.

Because of their disappearance from the region by 1450, historians must rely on archaeological research to shed light on their existence. After their migration from Mexico, the Hohokam settled near the Gila River. Drawing upon the available water in the river, they dug canals to channel water to their farm fields. As primitive of a system as this was, dug with stone tools, it would become one of the largest prehistoric irrigation systems. (Howard, p. 1) It also allowed the Hohokam to practice agriculture. The emphasis on agriculture encouraged settlement and led to growth of the Hohokam population (Gumerman, 1991, p. 246-247). The ability of the Hohokam to practice irrigation agriculture was crucial to their success in inhabiting a portion of the arid Southwest. It demonstrated that with a consistent supply of water, obtained through irrigation, people could survive in this inhospitable land.

Irrigation and water supply comes to the forefront again with Spain's colonization attempts during the 16<sup>th</sup> through early 19<sup>th</sup> centuries. As the Spaniards moved north from Mexico, they established settlements in the desert southwest. With the establishment of colonies in New Mexico under the command of Juan de Onate, Spanish settlement of the Southwest increased in the early Seventeenth century. As the Spanish brought more order to their

colony beginning with the establishment of San Gabriel, and later Santa Fe, the population of Spanish soldiers, missionaries, and traders increased. (Sanchez, 1994, p. 132)

With increased population came the need for reliable sources of water. One of the main necessities of the Spanish colonial settlement was in locating villages where a permanent source of water was available. (Rivera and Glick, 2005) The Spanish relied on the “acequias” system to provide them with water. Acequias is a form of canal irrigation that utilizes gravity to divert water to arid locales. As Spanish settlement of the Southwest continued they established systems of acequias irrigation to link their establishments. Olivares’ settlements on the San Antonio River in the early 1700’s were all connected by acequias systems. (Eckhardt)

The Spanish irrigation works exemplify a global convergence of ideas and technology. They drew upon their experiences in the arid Iberian Peninsula region of Europe to enhance the harsh landscape. To further the global context, the roots of the Spanish acequias system of irrigation can be traced back to the Arab conquerors of the Iberian Peninsula. The invading Moors created a lasting system of irrigation that the Spanish colonists drew upon in settling the Southwest. (Rivera & Glick, 2005)

Whereas the Hohokam had to rely on stone tools for production of their irrigation canals, the Spanish had the benefit of metal tools. This allowed them to build more permanent irrigation structures that needed less upkeep than those of the Hohokam. In fact, the San Antonio River acequias system commissioned by Olivares served as San Antonio’s water system for nearly two hundred years, far outlasting the dominion of the Spanish crown. (Eckhardt)

As the United States asserted its “manifest destiny” it became apparent that one of the most precious and necessary resources in the American West was water. Nowhere was this truer than in the arid regions of the Southwest. As Americans streamed west in the 19<sup>th</sup> century in search of gold or to stake their homestead, they encountered firsthand the harsh realities of the landscape. The need for irrigated lands became apparent. To this end, many private irrigation companies formed to meet the needs of the homesteading farmer. The outcomes of these private endeavors were not successful. (Reisner, 1986, p. 113)

Geologist and explorer, John Wesley Powell argued for the establishment of a federal network of irrigation systems in his 1879 work, *A Report on the Lands of the Arid Region of the United States*. Powell believed the private systems to be ineffective and advocated for "legislative action ... to inaugurate the enterprises by which these lands may eventually be rescued from their present worthless state." (Powell, 1879) Powell would, however, have to wait until 1902 for such a network.

Passed in 1902, after years of drought and unstable weather in the West, the Reclamation Act provided federal funds for the establishment of irrigation projects in the American West. Its passage, spurred on by the work of Senator Francis Newlands of Nevada, marked a drastic shift in irrigation policy in the United States. Most projects up to this time had been undertaken as private enterprises. With the full power of the U.S. Government, the newly created Bureau of Reclamation set about to transform the arid lands of the Southwest by building over 600 dams. The irrigation water provided by these dams greatly expanded the population density and farming capabilities of the region.

While the Reclamation Act succeeded in making the arid West more inhabitable and arable, one would be remiss to overlook the ecological impact of irrigation on such a massive scale. It is true the Hohokam and Spanish did change the landscape. The degree to which these changes altered the ecology of the Southwest, however, is miniscule in comparison to the large-scale ventures of the U.S. government. The indisputable fact is that as population increases more water will be consumed. The growth of the Sun Belt region (Southwest) in the 1980’s and 1990’s caused a major growth in population and with it increased demand for water. To this end, so much water is taken from the Colorado River that hardly any water makes it to the river’s natural endpoint. (Zielinski)

The progress of irrigation in the American Southwest demonstrates that when conditions dictate, human beings can and do modify their environment. The efficiency of such modifications increase with advances in technology and

the application of knowledge gained from others. The many groups who have settled in this region faced the challenging reality of living in a harsh, arid land. While maybe not always successful, they overcame those challenges through the application of technology. The greatest application of that technology came in developing irrigation systems. Through irrigation, the arid Southwest has been transformed into an increasingly more populated and important region of the United States. In doing so, however, the inhabitants are changing the ecology of the region. Therefore, irrigation and its impact on the American West is not just a topic for history, but one of the future.

### **3. Annotated Bibliography –**

**"Brief History." *Bureau of Reclamation Homepage*. Web. 30 Apr. 2011.**  
<http://www.usbr.gov/history/borhist.html>

This webpage contains an overview of the Bureau of Reclamation from its inception with the passage of the Reclamation Act through the present. Specific focus is paid to outcomes and impacts of the Bureau's projects.

**Eckhardt, Gregg. *The San Antonio River*. 1 May 2011.**  
<http://www.edwardsaquifer.net/sariver.html>

This article is a rather brief examination of the acequias system constructed along the San Antonio River. It provides a good historical account of the usage of the acequias system in the area.

**Fradkin, Phillip (1981). *A River No More*. New York: Knopf**  
Fradkin's book is an exploration of the Colorado River and its importance to the American Southwest. As one of the most heavily irrigated and dammed river in the United States, Fradkin argues that understanding the legacy of the Colorado is vital to studying the people of the region. This book provides a historical overview of irrigation in the Southwest.

**Gumerman, George (Editor) (1991). *Exploring the Hohokam*. Albuquerque: University of New Mexico**

This is a collected work of essays written by historians, anthropologists, and archaeologists dealing with the culture of the prehistoric Hohokam people. Jill Neitzel focuses particular attention to irrigation with her essay, *Hohokam Material Culture and Behavior*.

**Haury, Emil (1976). *The Hohokam: Desert Farmers and Craftsmen*. Tucson: Univ. of Arizona Press**  
Due to their prehistoric existence, much of what historians know about the Hohokam comes from the archaeological record. Archaeologist Emil Haury's work is of value to scholars interested in daily life among the Hohokam. Numerous black and white photographs help shape readers images of prehistoric life in an arid climate.

**Howard, Jerry. *Hohokam Legacy: Desert Canals*. Web. 3 May, 2011**  
<http://www.waterhistory.org/histories/hohokam2/>

A brief article describing the canals of the Hohokam as found in and around the Salt River Valley. Of particular use are the included maps and illustrations.

**Pisani, Donald (1992). *To Reclaim a Divided West: Water, Law, and Public Policy, 1848-1902*.**

**Albuquerque: University of New Mexico Press**

Pisani focuses on the emerging Republic's debate over how to settle the lands of the arid west. He traces the rise of private irrigation systems and how their subsequent failure necessitated the involvement of the federal government. This culminates in the passage of the Reclamation Act of 1902 which is covered in detail in Chapter 8.

**Powell, John Wesley. (1962) *A Report on the Land of the Arid Region of the United States*. Edited by Wallace Stegner. Cambridge: Belknap Press**

A seminal work by one of the strongest advocates of federal irrigation system in the West, this book gives a firsthand account of the climate and geology of the West. Also included are Powell's recommendations for dealing with water right issues in the region.

**Reisner, Marc (1986). *Cadillac Desert: The American West and Its Disappearing Water*. New York: Viking**

This work offers a historical look at the efforts to utilize the limited water in the American Southwest. Chapter 8 provides the reader with a survey of the Hohokam people and their efforts at irrigation in the Gila River valley. Reisner also sheds light on the climate factors that make irrigation a necessary part of daily life in this region. This is best exemplified by chapters 1 and 2.

**Rivera, Jose A., and Thomas F. Glick. "The Iberian Origins of New Mexico's Community Acequias." *Taos Valley Acequias Association*. Web. 30 Apr. 2011.**

**<http://www.taosacequias.org/Documents/GlickRivera409.pdf>**

This article provides a detailed history of the Spanish colonialist's promotion of an "acequias" irrigation system. It also details the influence of Arab invaders in bringing this system to Spain. This is paramount to understanding the global context of irrigation in the American Southwest.

**Rowley, William (1996). *Reclaiming the Arid West: The Career of Francis G. Newlands*. Bloomington, Indiana University Press**

Dealing with the life of one of the strongest advocates of federally funded irrigation, this work is beneficial in understanding Newlands role in the passage of the Reclamation Act of 1902. While a good portion deals with his early life and career, chapters 1 and 8 are of particular value to those interested in his advocacy for federal irrigation projects.

**Zielinski, Sarah (2010). "*The Colorado River Runs Dry*." *Smithsonian Magazine*, October**

This article provides an overview of the water flow issues on the Colorado River. Exploring the root causes of the flow disruptions nears its delta, mainly over irrigation; the article focuses on the future of water use in the American Southwest. Of particular interest is the suggested reading list for more detailed accounts of the issue.