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Dynamics of the Legal Environment and the Development of Communal Irrigation Systems

RESEARCH ARTICLE

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ABSTRACT

The success of local user groups managing communal natural resources depends to a great degree on external factors such as the legal environment. However, depending on their political power, the local users may exert some influence on the legal environment. This creates important dynamics between external legal factors and local resources governance. To explore this path dependent dynamic in common property resources, I conduct a historical case study of the development and legal transitions of acequias (irrigation ditches) in modern day New Mexico, US. Initially colonized by Spain in 1598, acequias have been developed and used for irrigation even as the region transferred from Spanish to Mexican to US sovereignty. The biggest legal changes occurred during the US territorial period (1851–1912), and I draw on the primary sources in the New Mexico Territorial Archives to better understand the origin, evolution, and motivation of irrigation statutes. I combine this with data on the timing of acequia and other irrigation enterprises development in New Mexico to show how the legal rules influence new development and how that new development shifts the vested interests and political coalitions, influencing future legal changes. The historical perspective highlights that external factors are important, but also that those factors are not entirely independent from the local systems: dynamic feedback loops create path dependence, in this case producing an incremental loss of local governance and power.

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1. INTRODUCTION

Like other natural resources, water can fall prone to the tragedy of commons.[1] However, a large body of work has highlighted that the tragedy metaphor is often too simplistic and that many user groups have sustainably managed resources and escaped the neo-classical economic outcome implied by the metaphor (e.g. Baland & Platteau, 1996; Ostrom, 1990, 2009). The commons literature, often seeking to show the importance and efficacy of local authority to govern natural resources, by and large focused on identifying *local* factors and conditions – user group characteristics, resource attributes, and local institutions – that influence success (Agrawal, 2003; Bennett, Acton, Epstein, Gruby, & Nenadovic, 2018). The imbalance means that external factors, like technology and broader governance arrangements as constraints (or support) of local rules have been relatively understudied (Agrawal, 2003).

In practice, disturbances to social-ecological systems (SESs) are wide and varied (Schoon & Cox, 2012). However, instability of common property regimes in the modern era is rooted less in internal dynamics than in external changes (Boelens, Hoogesteger, Swyngedouw, Vos, & Wester, 2016; McCarthy, 2009) and more work needs to be done to identify vulnerabilities of small-scale systems amid variability in the broader economic, political, and social systems they are embedded in (Janssen, Anderies, & Ostrom, 2007). In terms of broader governance, this has typically been about the government providing local users with autonomy and supportive sanctioning institutions; providing *de facto* local norms and rules the force of *du jure* law (Horowitz, 2015). Tensions, conflict, and stress can occur when legislative efforts are at odds with local customs (Alston, Harris, & Mueller, 2012; Crossland, 1990).

This has led to more attention to "institutional fit", or how well local rules and the regional setting align (Andersson, 2013; Cudney-Bueno & Basurto, 2009; Epstein et al., 2015). Political ecology considers broader systems at a variety of scales beyond proximate or local forces and pays greater attention to the dynamics of power (Robbins, 2012). Given the importance of external forces to the success of the commons, calls to integrate political ecology with the commons literature are becoming a common refrain (Armitage, 2008; Baggio et al., 2016; Fabinyi, Evans, & Foale, 2014). The combination can be approached from both directions: how do power structures shape institutions and how do institutions shape power structures (Bennett et al., 2018)? I take a historical perspective to explore both questions and their dynamic relationship. Specifically, I consider how external legal changes alter the incentives for how local users organize themselves and how those changes in local organizations alters the political coalitions, affecting subsequent legal changes.

To explore the question, I document and analyze the evolution of the legal environment and the development of communal irrigation systems, known as acequias, in current day New Mexico, US. Acequias have been held up as a case of a long-lived successful communal management regime of a natural resource (Cox, 2014a, 2014b; Smith, 2016). In the region of study, some acequias date back to the 16th century when Spain first colonized the area. The acequias have experienced sizeable shifts in their external legal surroundings, most rapidly and significantly during the US territorial period (1851–1912), that can be used to assess the relationship of external legislation and communal irrigation systems.

Based on an extensive review of the historical literature on New Mexico and acequias, I first present the basic principles that define acequias as an irrigation organization coupled with historical background of the settlement of the Southwest. I then focus on the laws of New Mexico's territorial period. I assess whether they encourage and support the acequias as local organizations based on commons theory and I explore the motivation for the laws by detailing legislative records from the New Mexico Territorial Archives. Finally, I gather and tabulate three sources of data on irrigation enterprise formation in New Mexico and compare the timing of the laws with origination dates of acequias and alternative irrigation organizations.

The most significant legal change occurred when New Mexico adopted a water code that shifted from communal, shared rights to seniority based, individual rights adjudicated and administered by the centralized Office of the State Engineer. While emblematic of James C. Scott's (1998) thesis that governments seek to make property rights legible, private and, thus, manipulable by the state, it warrants pointed out that this occurred in 1905, nearly 25 years *after* it happened in the other Western arid states. My argument is that the delay was rooted in the political power the acequias held initially but slowly lost, and, more broadly, that legal changes external from the local governance regimes are not entirely exogenous.

In this case, the early laws were supportive of the acequias' communal arrangements, and acequias continued to propagate. But slowly new irrigation interests did form, gaining small adjustments to water law that began to further incentivize alternative organizations. Only after these alternative irrigation organizations gained dominance did the political parameters shift, resulting in the narrow passage of the 1905 water code. Notably, the opposition came from council members that represented areas with more acequias. Legally and politically weakened, the challenges began to mount for the acequias afterwards.

The political ecology of the actual adjudication of water rights among acequia users in New Mexico has been well documented (Perramond, 2012, 2013, 2016) as well as other subsequent developments such as the introduction of irrigation districts along with the federal government's involvement in irrigation (Smith, 2018). Groundwater access and development beginning in the 1940s further altered the irrigation dynamics in New Mexico (Woodward, 1997). This study is distinct because it does not focus on any specific strife over a particular water source, but rather considers how the stage is set prior to acute scarcity and conflict. External rules and power dynamics shape who enters and how they enter, influencing political alliances down the road. That more supportive broader governance rules predict the emergence of self-governance arrangements has been documented (e.g. Andersson, 2013), but the feedback loops are not as well considered. Path dependence is an important factor in shaping collective action with prior outcomes creating feedbacks and shaping conditioning factors (Cody, Smith, Cox, & Andersson, 2015; North, 1990). This paper explicitly addresses dynamic political relationships, documenting how the broader governance arrangements are shaped by altering the vested interests slowly over time, ultimately increasing the exposure of the local groups to later disturbances.

2. SETTLEMENT AND IRRIGATION OF NEW MEXICO

Settlement of what is now the western United States required the development of irrigation for agricultural production given the aridity. The adoption of the prior appropriation doctrine – which grants water rights based on seniority, or first use – by most western states and types of organizations developed by Anglo-Americans have been explored (e.g. Bretsen & Hill, 2007; Leonard & Libecap, 2019). However, Spain began colonization of the region in 1598 long before any US settlement occurred (see ***Figure 1*** for the extent of New Spain that remained by 1819), leaving a distinct imprint on irrigation practices and organizations in the Southwest.

The Spanish settlements were guided by the Laws of the Indies issued by the Spanish Crown concerning the development and occupation of newly "discovered" lands. It stipulated characteristics that should be considered in selecting settlement locations including fertile soil, abundant pasture land, and above all, "good and plentiful water supply for drinking and irrigation" (Rivera & Glick, 2002, p. 4). Once officials inspected the land, confirming its promise to provide for the settlement, the land grant would be conferred, and the settlers would begin work. The irrigation infrastructure was typically the first undertaking, even prior to building the local church or government buildings (Rivera & Glick, 2002). Many of the historic acequias ran for a numerous miles, 4–6 feet deep and 14–15 feet wide (Sunseri, 1973).

An acequia – a term that refers both to the physical ditch and the organization – begins by building a diversion point upriver using a simple dam that directs the water into the *acequia Madre,* or main (mother) ditch. The system, generally comprised of unlined ditches and simple headgates, relies on gravity to convey water. Farmers who help build and maintain the system are known as *parciantes*. The unlined ditch requires considerable maintenance. Each spring free riding must be overcome, and the members spend 2–3 days fixing up the ditch. Thomas Glick (2002) contends that the common property management is rooted in the Islamic belief that water is sacred and must be provided to all who need it on the principles of sharing. The Muslim practice is that irrigation canals are the shared property of all those who labor on it and could not be subdivided into private property. This approach was adopted in the arid regions of Spain and subsequently transplanted to the Americas.[2]

Water apportionment in *Nuevo México* was driven by priority, but not as defined by the prior appropriation doctrine. Under that doctrine, irrigators are given priority based on seniority and junior irrigators –those that arrived later – are curtailed entirely during scarcity so the senior irrigators get their full right. Under Spanish water rules shortages were instead divided based on other factors including just title, prior use, need, injury to third party, intent, legal right and equity (Brown & Rivera, 2000; Ebright, 2001). For instance, small gardens typically were given water prior to large alfalfa fields. Overall, it was a flexible community-based irrigation system in which rarely did anyone get all they asked for, but everyone got something. Malcolm Ebright suggests the role and importance of the system, stating, "A rigid winner-take-all water system was inimical to community solidarity, and without community there was no surviving the harsh realities of frontier life." (2001, p. 32).

During drought periods, users of a shared acequia divide the water by time on a rotational basis (*temporalis*). In many regions, division among acequias that divert from the same stream also occurs on a rotational and proportional basis (Cox & Ross, 2011; Smith, 2021). As communities grew, it became necessary to choose an administrator of the acequia, commonly called the *mayordomo*, to organize maintenance and water distribution.[3] The position is democratically elected by *parciantes* of the acequia annually. Rivera and Glick (2002) believe a crucial condition for success is the discretionary authority entrusted to the *mayordomo* through the flexibility of local control.

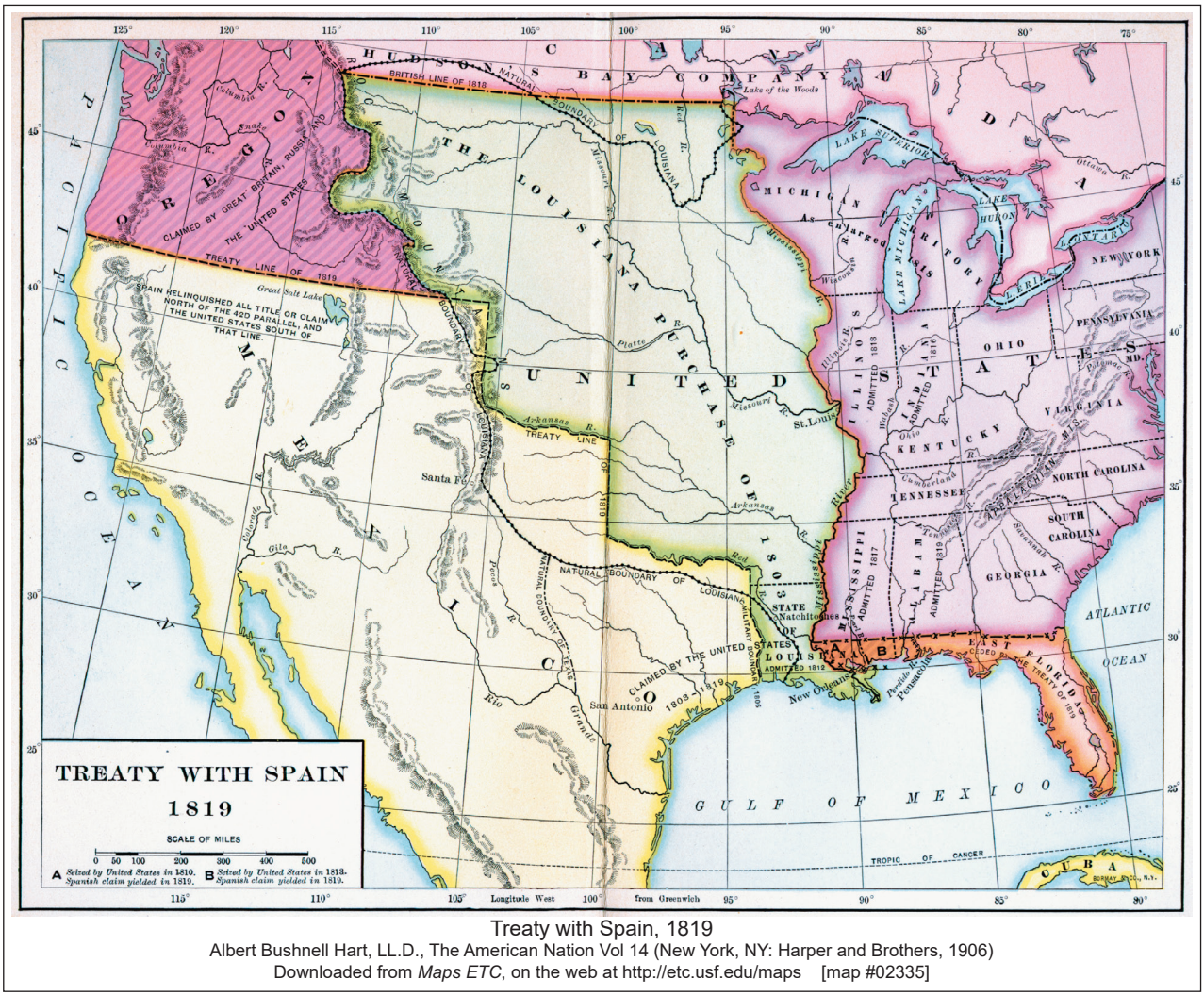

Figure 1 North American Spanish Territory, 1819.

Notes: Albert Bushnell Hart, LL.D., The American Nation Vol 14 (New York, NY: Harper and Brothers, 1906).*Source*: Maps ETC, downloaded from *https://etc.usf.edu/maps/pages/2300/2335/2335.htm*.

The acequias have provided a model for communal and ecological benefits that can be provided beyond the economic benefits of irrigation. For many, it is the most local form of government and builds a sense of community. Sylvia Rodríguez (2006) explores the community nature of the organization and its intimate relationship with religion. On the ecological front, beyond the extended riparian zone, acequias utilize renewable energy (gravity) to provide water, typically utilize riparian long lots rather than the grid system, rely on natural pest and weed control, and utilize local landraces and polyculture (Peña, 1999).

In 1821, Mexico gained its independence from Spain and the legal context in which the acequias operated within began to change. The pace and extent of change accelerated shortly after the area came under US jurisdiction in the late 1840s. Many of the Anglo-American newcomers viewed the acequias as inefficient modes of irrigation. They felt, "[farming] has been pursued merely as a means of living, and no effort has been made to add science to culture in the introduction of an improved mode of husbandry" (Sunseri, 1973, p. 334).

During the 20th century, many acequias were subsumed by large irrigation districts (Smith, 2018) while those remaining faced intrusive and contentious adjudication processes (Perramond, 2016). I focus on what preceded those changes to explore the dynamics of political power and local resource governance. As irrigation rules changed, formation of alternative irrigation organizations was incentivized. Ultimately this altered the vested interests and political coalitions in the irrigation space leading to additional rule changes that further weakened local acequia management.

3. DATA AND METHODS

Acequias were established throughout the Southwest (Arizona, California, Colorado, New Mexico, and Texas), but continue to exist today primarily in New Mexico and a few southern Colorado counties. While the Spanish and Mexican laws applied equally to both regions, water law in the US is predominantly at the state level. Accordingly, the analysis here focuses on New Mexico where acequias were more dominant.[4] The data are comprised of two general types. First, qualitative data on relevant irrigation laws and procedures as well as information on the political process that brought them about. Second, irrigation ditch formation, both total and acequia specific, are tabulated from several sources by time period.

With these data, I consider the laws enacted and assess whether they have the features that are conducive to local management of common-pool resources and explore the circumstance of their passage. These changes are compared to the formation of acequias and alternative irrigation enterprise preceding and following their implementation to assess how the political coalitions both shape legal changes and are altered by legal changes.

For qualitative data, general historical facts are gathered from a review of the literature (e.g. Baxter, 1997; Clark, 1987; New Mexico Historical Review, 1952). In addition, I identified relevant treaty provisions and irrigation laws from New Mexico drawing on historical and modern compilations of New Mexico's laws (New Mexico Compilation Commission, 2019; Victory, 1897). A review of all statutes pertaining specifically to acequias (Chapter 73) as well as more general laws affecting irrigation identified a subset of legal changes worth additional research. These are summarized in ***Table 1***.

For these more critical rule changes identified in ***Table 1***, I looked to the New Mexico Territorial Archives (NMSRCA, 1971), available on microfiche at the Denver Public Library, to provide more context. The format and amount of detail provided in the archive records varies considerably between 1851 and 1912. Still, the primary source yields information on the legislative body, vote counts, and statements from the governor and legislative committees that provide insights into the motivation for several statutes, but not all.

To connect the pertinent changes in external law to the strength of acequias politically, my analysis focuses on the origination date of irrigation organizations to compare their relative prevalence at various points in time. Two sources have been located on acequia formation.[5] The first is found in Hutchins (1928b) and contains 480 acequias. The second is presented in Ackerly (1996) with the underlying raw data available on Ackerly's webpage (Dos Rios Consultant Inc., 1996). I rely primarily on the data from Ackerly because it appears more complete, includes acequias that no longer exist, and breaks down the tabulations by county. Qualitatively, the trends are similar in both data sets and analysis with Hutchin's (1928b) tally are provided in the appendix for comparison. In total, Dos Rio Consultants, Inc. identifies 1496 acequias in New Mexico, over 1000 more than Hutchins. 608 acequias have no date and another 82 simply are dated "pre-1900" and are dropped from the temporal analysis. Despite these missing dates, the overall trend is expected to be representative, particularly during the territorial period (1851–1912) even if exact numbers are off.[6]

Last, for tabulations inclusive of non-acequias, data from the US Census of 1910 and 1920 are utilized (US Bureau of the Census, 1913, 1922). Most pertinent, data are provided in the 1920 Census (by state) concerning the

YEAR	EVENT
1598	**Spanish colonization begins**
1821	**Mexican independence**
1848	**Treaty of Guadalupe Hidalgo ends the Mexican-American War**
1851	New Mexico Territory is formed and initial legislation codifies acequia traditions
1887	Legislation allows corporations to form for irrigation development
1895	House bill 72 alters and imposes new administrative structure on acequias
1905	Sweeping new water code creates private water rights for central administration
1909	Legislation allowing for irrigation districts passed
1912	New Mexico transitions from US Territory to State
1914	Snow v. Abalos decision disallows communal ownership of water

Table 1 Key Legal Changes for Acequias in New Mexico.

Notes: Summary of legal events discussed in the text. Bolded events indicate a change in sovereignty for the region.

number of irrigation enterprises originating each decade.[7] These numbers are used to anchor the absolute number of acequias forming relative to all irrigation development occurring in New Mexico.

4. ANALYSIS

4.1 MEXICAN LEGAL ENVIRONMENT

Mexico gained its independence from Spain in 1821, giving the newly sovereign country the lands of *Nuevo México*. Mexico adopted looser colonization laws than Spain had, but did not disturb the laws and customs concerning the community acequias (Hutchins, 1928b). In fact, the initial statutes of the governing the region under Mexican rule are quite sparse, numbering only thirteen. Notably, nearly a third concern water, underscoring water's importance.[8] All of them bolster the local communal acequias. §4 provides external support of the appropriation by fining anyone taking water out of turn, dictating a third of which to goes to the individual that was lost water due to the transgression, providing incentive to report the infraction beyond the shortage of water.[9] Underscoring the community nature of endeavors in this period, §5 required all those in the community to labor on the mother ditch, among other community projects like the church. Failure to do so resulted in a fine. Both these statutes strengthened the acequia by providing local authorities with external support to enforce their decisions.

Overall, this transition to Mexican rule did little to disrupt the development of acequias for irrigation. ***Figure 2*** provides the overall counts of acequia formation by decade from Dos Rios Consultant, Inc. (1996).[10] The number of acequias originating during the Mexican period – 26 per decade – shows no drop off from the prior decades under Spanish rule and even exhibits a small uptick from the 1810s to the 1820s. The increase could capture Mexico's laxer immigration policy. This lends empirical support to Hutchin's (1928b) assessment that little changed concerning the irrigation in this transition and the acequia remained the irrigation organization of choice during Mexico's rule of the region. In fact, beyond the ditches already in place by indigenous tribes, no evidence has been turned up to suggest non-acequia ditches were dug during this period. In terms of irrigation enterprises, acequias were quite dominant in New Mexico through the end of the Mexican period.

4.2 UNITED STATES LEGAL ENVIRONMENT

In 1846 Stephen Watts Kearny occupied New Mexico, claiming it for the United States. In doing so, he promised all persons of the province protection of their liberty and property in The Kearny Code. It states, "laws heretofore in force concerning water courses, stock marks, and brands, horses, enclosures, commons and arbitrations shall continue in force" (Victory, 1897, p. 90). The regulation of such things remained with authorities at the village level. Although

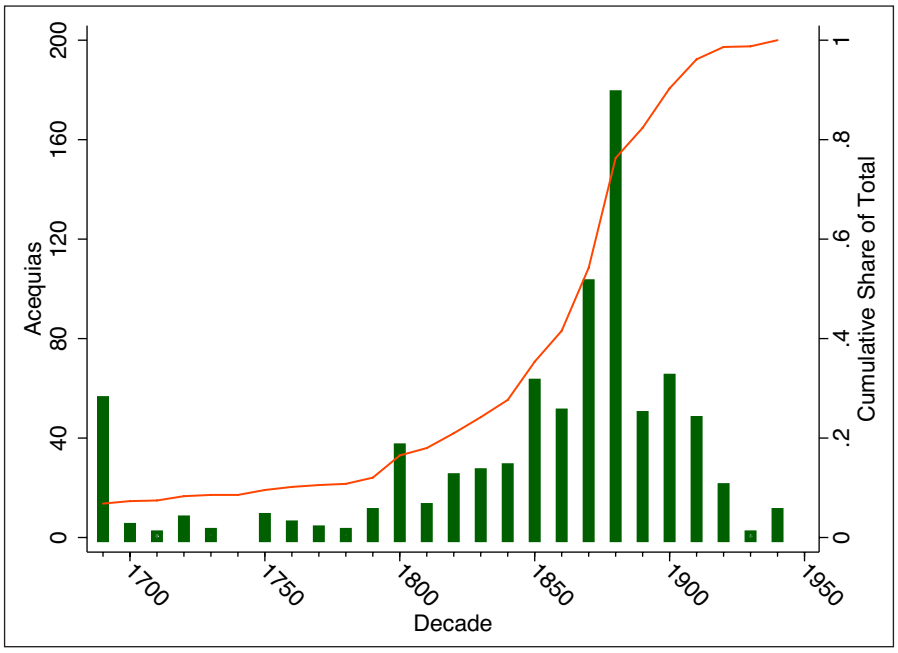

Figure 2 Acequia Formation in New Mexico.

Notes: Acequia formation in New Mexico binned by decade. Decades are marked by their first year (e.g., 1860 covers 1860 to 1869). The 1690 tally includes all pre-existing acequias. The cumulative share of the eventual total is indicated by the orange line.

Sources: Author's rendering of Dos Rios Consultant, Inc. (1996) acequia data.

Kearny's authority to have made such guarantees was dubious, similar protection was extended in the 1848 Treaty of Guadalupe Hidalgo (Clark, 1987). The treaty officially gave the US sovereignty over the area while protecting the existing occupants' prior rights: "property of every kind now belonging to Mexicans now established there, shall be inviolably respected" (Victory, 1897, p. 31). The recognition of prior property rights left the acequia in a legally strong position despite the jarring transition to a new country.

The first territorial legislative sessions of 1851 and 1852 further enhanced acequia rights by putting into statutory form many of the informal rules that had guided the water democracies for centuries. The ability to shape the initial legislation no doubt stems from the lack of political competition. Not only were acequias the dominant irrigation organization, but more generally the legislature was comprised mostly of Hispanics with only a few Anglo representatives (Clark, 1987). Indicative of the importance of irrigation and the organization at that time, the first eleven territorial statutes related to acequias. The first made it illegal to block any water ways, reasoning that efforts towards the "irrigation of the fields should be preferable to all others" (Victory, 1897, p. 96). The second statute emphasized primacy of irrigation, establishing the right to use eminent domain to construct ditches to get water from the closest source. The legislature further forbade any disturbance to those ditches already in place.

Overall, the *de facto* rights became the *de jure* rights in New Mexico during the first legislative session and provided local authority with external support. As another example, any person in default for labor payments became subject to arrest the same as any other offenses against the territory (Victory, 1897, p. 97). The external threat of enforcement gave considerable gravity to the locally levied sanctions. The early statutes concerning the water law in New Mexico allowed for the acequias to operate largely uninhibited and with legitimacy.

During this initial territorial period, there was a surge in irrigation construction in New Mexico, including the construction of acequias. Drawing on data shown in ***Figure 2***, 62 new ditches were organized in the first full decade of US rule, 1850–1859. The influx of new acequias, the most in any single decade up to that point, suggests that the original laws of the territory made the acequia an attractive structure to use and they remained a preferable irrigation system.[11] While the decade saw an increase of over 50% in the population, it was mostly from a natural increase of the local population, not immigration (Baxter, 1997). The continued use of acequias, given the demographic growth and continued support by the external legal environment aligns with the theory that supportive broader governance incentivizes the emergence of local self-governance.

Even as the population began to grow from the inflow of Anglo-Americans headed west, acequias continued to be constructed as New Mexico law did not yet favor other organizations. New construction grew to 102 in the 1870s and then peaked at 178 in the 1880s. With the railroad arriving in 1879, the territory's population increased from 91,874 to 160,282 from 1870 to 1890. The population growth likely contributed to the rate of acequia construction, but the trend is also influenced by the legal status of acequias continuing to support and incentivize that organization for irrigation.

Figure 3 shows all (acequia and non-acequia) irrigation enterprises formed in New Mexico by decade from US Census data, beginning in the 1850s.[12] The first panel (A) provides the total number of enterprises. The second panel (B) combines the census data with the acequia specific data to show acequias as share of all new enterprises in each decade. While the total number of new enterprises trended up from 1850 onward, acequias remained a relatively steady proportion (40–60 percent) from the 1850s through the 1880s. However, unlike the prior decades under Mexican and Spanish rule, this also shows that non-acequia irrigation enterprises were forming, creating a new set of political interests.

Following the initial rules in 1851 and 1852, the legislature continued to promulgate laws affecting the acequias, but mostly addressing marginal issues such as the obligation to build bridges over the ditch and when meetings should be held. On the surface, the trend was positive, as the laws codified the traditional structure, but John Brown and José Rivera (2000) point out that it simultaneously created a tension with autonomy and discretion.[13] By writing tradition into law, the acequias became limited in their ability to depart from the customs when it might be prudent to do so. The codification of local rules "freezes" a living process and "sacrifice[s] much of their plasticity and subtle adaptability" (Scott, 1998, p. 35).

Perhaps most illustrative of the tension that codification can create between state support of local discretion and limiting that discretion among the first acequia laws in 1851 is what are now New Mexico Statutes §73-2-30 through 32. The first strengthened the local decisions by giving the *mayordomo* state authority to require acequia proprietors to furnish laborers to maintain the ditch when requested. The second further backs the local decision by levying a civil cash penalty for those disregarding the *mayordomo's* request. However, the statute also constrains the penalties available to the mayordomo, dictating cash rather than loss of water or other options that may have been situationally prudent. Finally, the third component ties the mayordomos' hands further by restricting the range

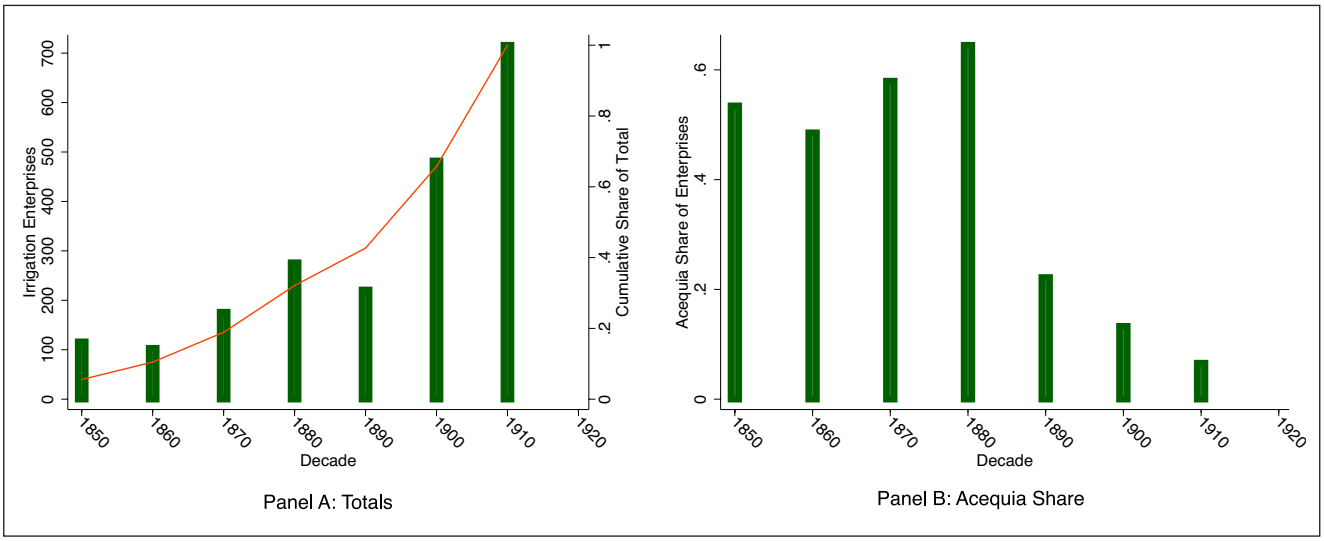

Figure 3 Irrigation Enterprise Formation in New Mexico.

Sources: Author's rendering of 1920 U.S. Census (1922), State Compendium New Mexico, Irrigation Section, table 3, pg. 67 and Dos Rio Consultants, Inc. (1996) data.

Notes: Irrigation enterprise formation in New Mexico binned by decade. Decades are marked by their first year (e.g., 1860 covers 1860 to 1869). Panel A includes both acequias and non-acequias, which are not distinguished in the census data. The cumulative share of the eventual total is indicated by the orange line. Panel B shows the share of the total number of irrigation enterprises formed that were acequias during each decade by dividing the acequia count shown in figure 2 by the total count shown in Panel A of this figure.

of permittable items the fines recovered can be applied to, including prioritizing bridges where public roads cross an acequia. The upshot is that the external government began to create one-size-fits-all solutions, albeit based on historic tradition.

The first real shifts away from pro-acequia legal treatment came in 1880s. Although acequias were still the dominant organization, their near monolithic role in irrigation had been chipped away at along with demographic and political shifts at the territorial level. The locus of irrigation control began to move beyond the local communities. As of the 1880s, many water disputes were no longer being settled by county probate courts and were increasingly falling on the docket of the territorial district courts. John Baxter (1997) argues that the use of district courts, where the judges were federally appointed and knew little of local water administration compared to the locally elected probate court judges, favored the eastern businessmen approaching water as an investment. The Hispanic population found themselves in an unfamiliar court system where legal technicalities often determined the outcome. Even in cases involving only Hispanic parties, it was often Anglo lawyers and judges that determined the outcome of the case.

In 1887, the legislature explicitly welcomed and sought outside irrigation investment, establishing the right for corporations to form for the purposes of irrigation. The 27th Legislature convened on December 27, 1886, greeted by a note from Governor Edmund G. Ross. He set forth the "need" for large scale irrigation, saying:

> "It is believed that legislative encouragement of the organization of incorporated companies for this method of developing water, and the supply of water for irrigation purposes to the lower lying lands, would result in bringing under cultivation very large areas of country now desolate and valueless and stimulate immigration, settlement and development to a degree now possible." (NMSRCA, 1971, pt. 6)

In response, Mr. Laughlin of Santa Fe County introduced Council Bill 80. The bill passed the Council on a vote 10–2. With no records of ayes and nays, the same passed the House of Representatives on February 18, 1887. With that, "An Act to authorize the formation of companies for the purpose of constructing irrigating and other canals and the colonization and improvement of lands" became law and drastically altered the incentives in irrigation.

The new irrigation organization provided the means to raise capital for large-scale projects, though in reality many operations failed (Hutchins, 1930). The desire for such changes followed the arrival of the railroad in 1879, bringing droves of Americans west. In a case in 1897, the judge sums up the Anglo elites' view of the acequias; "'I do not underestimate the present ditch system, in some respects it is very good and so long as it is in existence its

status and rights must be upheld by the courts; but it is not an economical system [...] it would seem strange that a system more than one hundred years old could not be improved.'" (as quoted in Baxter, 1997, p. 95). The judge's view was likely biased by the state's emphasis on growth and expansion and thus underemphasized the acequias' suitability to the local conditions that allowed them to survive for one hundred years. The first US report on agriculture by irrigation in 1890 (US Census Office, 1894) also lambasted the "primitive character" of the acequias but did note that crop loss "from lack of water is unusual, since by long experience the inhabitants have learned to adapt their acreage to the probable supply from the streams" (p. 201).

In addition, the legislative body passed new statutes in 1895 altering the organization of the acequias which were not based on tradition. House Bill 72 passed the House unanimously and passed the Council 10–2 (NMSRCA, 1971). The bill contained a number of statutes, but three fundamentally altered the structure of the institution. First, all acequias were now required to elect three commissioners in addition to the *mayordomo*. Second, the bill spelled out the procedure to elect them. Third, it defined the roles of the required officers.[14] This statute broke with tradition. Although some acequias had had commissioners before, many only had a *mayordomo* and in all instances the *mayordomo* was the "superior officer" (Hutchins, 1928a, p. 233). This power reversal relegated the *mayordomo* to the domain of ditch maintenance and water delivery. By 1909, 21 percent of acequias still lacked commissioners (Hutchins, 1928a), underscoring both the statute's misalignment with some local variants and the disconnect between formal statutes and local practice.[15] Finally, the law altered the sanctions available to the *mayordomo;* no longer were fines permitted, but rather the denial of water became the sanction (NM Statutes, §73-2-25). The territorial legislature recognized the community acequias were too numerous and important to void, so they instead legally recognized them and simultaneously tied their hands, creating room for other legal organizations to coexist, such as water companies and, eventually, irrigation districts (Buynak, Widdison, Brown, & Kelly, 2010).

The judicial and legislative changes in the late 1880s and early 1890s helped reshape the irrigation organization landscape as can be seen in ***Figure 3***. Although the 1890s saw fewer new irrigation organizations than during the 1880s overall, more notable is that the share of acequias fell drastically from 64 percent in the 1880s to 22 percent during the 1890s. As Anglo doctrine was taking a stronger hold on the region the acequias prominence in water politics dwindled. Although a generous interpretation of the data suggests acequias were still at 74 percent of irrigation organizations in New Mexico by 1900, measured by acres and political influence, the power balance was no doubt leaning further away from the acequias.[16] By 1903, Hispanics no longer dominated the legislature: based on surnames, 18 Hispanic representatives and 18 Anglo representatives made up the 35th legislative assembly.[17]

1905 witnessed massive centralization of power in irrigation in addition to a move towards private water rights. The 36th territorial legislature passed House bill number 98, adopting the prior appropriation doctrine. Under this doctrine, water rights are private, severable from the appurtenant land, measured by volume and based on seniority—conceptually orthogonal to Spanish practice of communal water, divided by time on a basis of need. Additionally, the water code established the Office of the Territorial Engineer (today, the State Engineer) to centrally adjudicate and administer the newly created water rights.

Urged by the governor Miguel A. Otero and the Irrigation committee of New Mexico, the legislation aimed to mimic the water code in force in other western states like Colorado and Wyoming. The goal was to create a legal environment to attract irrigation projects from the new Federal Reclamation program (now the Bureau of Reclamation), formed in 1902 to support irrigation development in the US. The Governor noted, "the future growth and continued prosperity of our people as a whole, must depend a great degree upon the extent and success in the development of our agricultural resources" (NMSRCA, 1971, pt. 18). The sentiment was echoed by the Irrigation Committee: "The preservation and proper use of water for the irrigation of lands in New Mexico is very important, and lies at the basis of all our material wealth developed and to be developed" (NMSRCA, 1971, pt. 18).

Unlike the more nuanced preceding legal changes, this one clearly pivoted away from acequias. At the time it passed, the acequias maintained strong, if diminished, political clout and there was opposition to passing the law. Proponents were mindful of the acequias' opposition, hoping they could craft the law "without interfering in the operation or management of community ditches." The bill only narrowly passed the Council on March 15, 1905 in a 6–5 vote (NMSRCA, 1971, pt. 17).

Additional evidence supports the notion that the political opposition relates to the political power of the acequias. First, New Mexico was quite late in formally adopting the prior appropriation doctrine relative to others in the West. According to Leonard and Libecap (2019), the other 16 western states all adopted the prior appropriation doctrine by 1891. The average year was 1881 and California adopted it in 1855.[18] This puts New Mexico nearly twenty-five years behind most other states and fifteen years behind Oregon, the latest of the other states. Arguably,

it was the political power of the acequias, absent in the other states, that caused a delay. New Mexico could only pass the change once other political interests had gained sufficient representation. This temporal argument – that the private rights were only adopted once acequias were being outpaced by alternative irrigation organizations – is bolstered by the spatial variation of the votes.

To connect political opposition to the acequias, the votes for the water code in the Territorial Archives can be compared to county tabulations of historic acequias, mapped in ***Figure 4***.[19] The Council members opposed represent counties with more acequias. In fact, the "no" votes come from counties that account for over two-thirds of the acequias in New Mexico while it was introduced by

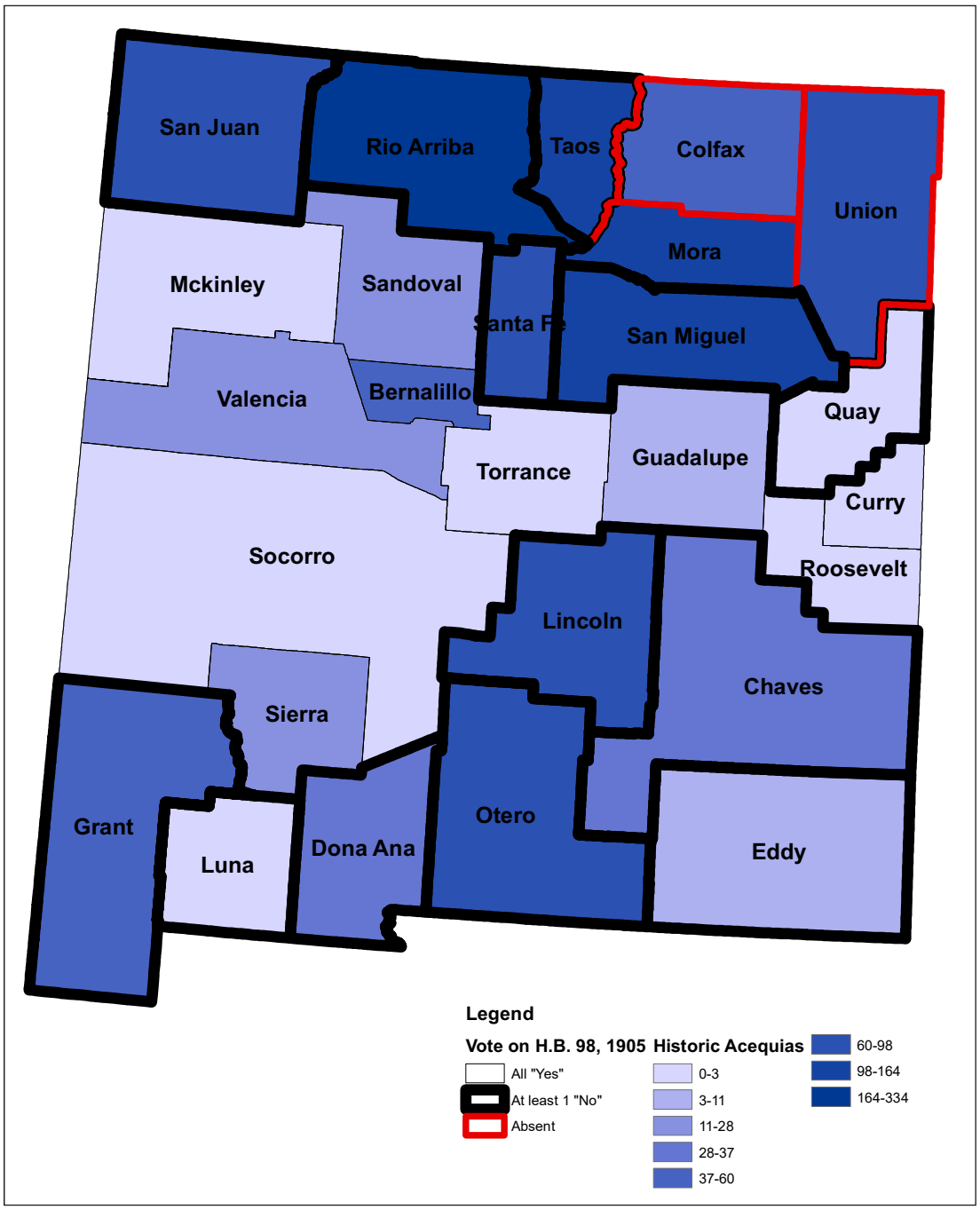

Figure 4 Historic Acequia Counts and Votes for Prior Appropriation Doctrine (1905).

Notes: Counties and their borders are as of 1910. Tables A2 and A3 in the appendix provide the underlying data.

Sources: Author's rendering of Dos Rios Consultant, Inc. (1996) acequia data and voting records of the Council of House bill No. 98 as recorded in the New Mexico Territorial Archives (NMSCRA, 1971). 1910 Borders from NHGIS (Manson, Schroeder, Riper, Kugler, & Ruggles, 2020).

Carl Dailies, representing a district (Valencia and Torrance Counties) with just 25, or 1.6 percent, of the 1496 historic acequias. It is notable that the Council member for Colfax, Mora, and Union, representing another 20 percent of the acequias, was absent from the vote. Although nothing in the archives offers concrete support, given the votes in the other acequia-heavy counties, the timing of the vote and absence of the council member may have been critical to the narrow passage. The centralization of power and adoption of prior appropriation posed a real threat to the acequias and was passed barely over their opposition.

The new legal framework disincentivized additional irrigation development by acequias. Shown back in ***Figure 2***, only 142 new acequias formed between 1900 and 1950. This decline is related to the legislative changes, not a lack of population growth or construction of new irrigation systems. From 1900–1910, the population grew 67.7, the largest absolute and percentage decadal growth in the territorial period. Over this same decade, 1900–1909, the number of irrigated farms increased 40.2% and total acreage under irrigation grew by 126.5%, according to the US 1910 Census. ***Figure 3*** indicates that irrigation enterprises formed more than ever before; the growth in irrigated acres during the 1900–1909 came from 482 new irrigation enterprises, of which only 64 were acequias. And while new acequias from 1910–1919 number 47, this was a mere 6.5 percent of 716 more new irrigation enterprises overall in that decade. Irrigation, therefore, did not fall off, but forms of organization other than acequias became the dominant structure following the alterations of water law.

The power acequias held at the beginning of the territorial period had vanished considerably by statehood (1912) and continued to erode now that other irrigation forms had a strong foothold. Further hurting the acequias' ability to operate in the new legal landscape, in the 1914 *Snow v. Abalos* case of the New Mexico Supreme Court, it was found that the acequia owned only the ditch and that individual *parciantes* owned the water rights privately, for it is they, not the ditch, who perfected the right by putting the water to use (*Snow v. Abalos, 140 P. 1044, 18 N.M. 681 -NMSC- 022*, 1914). Not until 1987 did acequias again acquire the ability to hold water rights as an organization.

Alternative water organizations, set off by the statutes of 1887, continued to gain recognition and power. The legislature enhanced the power of irrigation districts in 1919 (first permitted in 1909) and created the framework for conservancy districts in 1923. Charlotte Crossland (1990) performs an analysis of the relative strength of alternative irrigation organizations in New Mexico based on the statutes governing them. She finds, despite being the oldest, the acequias at the end of the 20th century were among the weakest forms. For instance, all other organizations have a "necessary and proper" clause – a right to go beyond their enumerated powers to do whatever is necessary and proper to carry out their purpose – but the acequias do not, a marked lack of autonomy. In other words, the acequias actions are limited only to those powers explicitly enumerated while every other irrigation organization type in New Mexico can, when necessary and proper, exercise unspecified steps to maintain its infrastructure and deliver water. Hutchins (1928a) also points out that, among the enumerated powers, acequias have no ability to take on debt in order to finance operations, a luxury afforded to irrigation and conservancy districts.

These alternative irrigation systems now have more statutory power in performing the same task of distributing and managing irrigation water than the acequias have. These changes in the external environment caused the acequia organization to be more difficult to operate, and thus, less popular relative to other organizational institutions available. Many acequias were subsumed by irrigation districts (Smith, 2018) and the actual adjudication process for individual water rights began in the 1960s and continues today, presenting challenges for the local communal arrangements to thrive.

5. DISCUSSION AND CONCLUSION

The evidence presented makes a compelling case that the communal irrigation systems in New Mexico slowly lost political power, contributing to the legal environment to shift towards other organizations, and ultimately making it difficult for the acequias to operate. The analysis, however, is not causal and other factors besides the changing legal framework likely played a role, or at least were proximate causes for the legal changes beyond the waning political coalition of Hispanic irrigators. Still, these potential additional factors – migration, market connections, federal development, etc. – were largely external to the acequias themselves.

Beyond the legal history documented here the actual creation of large irrigation districts like Elephant Butte in 1918 (Smith, 2018), the Rio Grande Water Compact in 1938 (Paddock, 2001), groundwater development beginning in the 1940s (Edwards & Smith, 2018; Woodward, 1997), and the actual adjudication of water rights across New Mexico starting in the 1960s (Perramond, 2013) all altered the external setting for acequias even more. The evidence presented in this paper suggests that the acequias' political power had been weakened prior to these events, making all these changes more challenging to navigate.

With Western history often dominated by the Anglo-American actors and their perspective (Limerick, 1987), this case study helps fill "historical blindspots" around race and power in the study of resource use in the West (Martin et al., 2019). However, it still sets aside the indigenous

populations and their role in water law and use in New Mexico and in the West more broadly (Sanchez, Edwards, & Leonard, 2020). More generally, this case emphasizes the study of local social-ecological systems should consider external factors shaping collective action more carefully (Agrawal, 2003). This aligns for the call for more research focused both on how institutions shapes power and how power shapes institutions (Bennett et al., 2018). This should include approaches that isolate causality of one direction or the other. The historical case here, however, does highlight the importance of path dependence. This does not mean the path is inevitable, just that earlier events alter conditioning factors such that later scenarios, even for the same users, can yield different results (Cody et al., 2015). In other words, although political power shapes outcomes, that political power is derived from past events.

While power was slowly stripped away from acequia associations, many have persisted and still operate today, largely due to the fact that New Mexico did include their customs in shaping the water law and sought to offer them protection. Recalling the governor's request for irrigation corporations in 1887, he also said, "it will of course be necessary to have regard for the fixed nature of existing conditions in respect to the system of acequias now in operation" (NMSRCA, 1971, pt. 6). This continues today. For instance, as the state attempted to adjudicate water rights, a fund was set up for acequias to assist in litigation, providing locals with state funds to protect their institutions.[20] This is a complementary point to the internal evolution of acequias and irrigation within New Mexico documented here; the New Mexico acequias have done *relatively* well due to their initial numbers in the region and political power compared to Hispanic irrigation in other states of the Southwest. The smattering of acequias in Colorado, having long lacked recognition in that state, only gained special recognition to deviate in some ways from ditches through the Acequias Recognition Act (House Bill 09-1233) in 2009.

With little new irrigation developing today, the acequias now struggle to navigate social, legal, and hydrological disturbances (Cox, 2014b; Cox & Ross, 2011; Perramond, 2016; Smith, 2016). Although the local factors will remain important in determining their success, the external legal environment they find themselves is also influential. The case of acequias in New Mexico demonstrates how communal organizations are able to grow when given support from the external government, but that their role in water development diminishes as statutes begin to favor other organizations. With a weaker political coalition, future changes were even less favorable for acequias. Future research should continue to study how external factors are shaped and how they influence the operation and success of local communal management regimes.

NOTES

1 The term popularized in Hardin (1968) addresses the disparate private incentives from social optimum common to resources that are rival in consumption but lack excludability. For the basic economic model, see Gordon (1954).

2 The irrigation practices in the Southwest are also melded with those in place by the indigenous population that pre-dated Spanish colonization. The main difference was in governance, the Pueblo tribes used a ditch chief for provision concerns and a cacique for appropriation matters. See Sunseri (1973) for further detail.

3 Stanley Crawford (1988) provides an excellent account of spending a year as *mayordomo* in his memoir.

4 The Colorado acequias were even governed by New Mexico Territory from 1850 until 1861 when Colorado Territory was formed. See Hicks and Peña (2003) for legal background of the Colorado acequias and Cody (2019) and Smith (2021) for empirical comparisons of acequias in the two states.

5 A third source is available from the State Engineers office (Saavedra, 1987), but lacks information on the timing of original construction.

6 The missing dates are likely biased towards older acequias, perhaps even randomly distributed, but unlikely to be biased towards "newer" acequias built during the decades (1850–1920) under closer examination. Table A1 of the appendix provides the data in tabular form.

7 The census table is reproduced in figure A1 of the appendix. Many of these appear to have failed or consolidated, as the same table in the 1930 Census (US Bureau of the Census, 1932), with another 10 years totals only 1,620 acequias compared to 2,090 in the 1920 data.

8 These statutes are found in "Provincial Statutes, 1824–1826." New Mexico Historical Review 27, no. 1 (1952): pp. 69–72.

9 Part of the statute reads "from which effrontery regularly follow blows which always bring some sad result," suggesting the transgression did not go unpunished without the statute, but with the official fine, violent solutions could be avoided.

10 Figure A2 in the appendix provides the same using the Hutchins (1928b) acequia data.

11 Reviewers raise some concern the uptick could be explained by better data collection under US rule. However, the US did not systematically survey irrigation practices until the 1890 Census and these figures are based on historical research by Dos Rios Consultants (1996). To the extent more recent acequias survived or at least records of their existence and founding, there may exist some biases in the data, but it is unlikely to account for patterns observed, particularly because the trend reverses and construction rates decline later.

12 Alternative combinations using the 1930 census data and the Hutchin's (1928b) data are provide in the appendix, figures A3-A5.

13 This sentiment is also present in Buynak, Widdison, Brown, & Kelly (2010).

14 See New Mexico Statutes §73-2-12, §73-2-14, and §73-2-21.

15 This relates to Scott's (1998) point that "we must never assume that local practice conforms with state theory" (pg. 49).

16 74 percent is arrived at by taking the cumulative acequias in 1900 from Dos Rios Inc. (1996) and dividing by the cumulative irrigation count of enterprises prior to 1900 in the 1920 census. This presumes all acequias in the count were still active at that time, likely overstating their presence.

17 Surnames were classified as Hispanic if they were found in the top 1000 surnames of Latinos in the US by Butler (2020).

18 Leonard and Libecap (2019) also date New Mexico's adoption of the prior appropriation doctrine as the earliest, 1851. This date is based on the notion that Kearny Cody affirmed "laws heretofore in force concerning water courses…shall continue in force" and the argument that prior appropriation had been deployed by Spain and Mexico. But Hutchins (1971, pp. 160–162) points out this interpretation is questionable and that it was never the basis of adoption in other places (Texas and California) where Spanish and

Mexican irrigation also existed. Perhaps the best evidence that the issue was not settled is that legislature felt compelled to pass the water code in 1905.

[19] Voting records and acequia counts are tabulated in the appendix, table A1 and table A2 respectively.

[20] See New Mexico Statutes, §72-2A-1 through §72-2A-3.

ADDITIONAL FILE

The additional file for this article can be found as follows:

- **Appendix A.** Additional Figures and Tables. DOI: *https://doi.org/10.5334/ijc.1112.s1*

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COMPETING INTERESTS

The author has no competing interests to declare.

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