Speaker Biographies

Arnold Valdez

Arnold Valdez, Principle of Valdez & Associates and Rezolana Farm, San Luis, Colorado, obtained his MA at the University of New Mexico in 1992, receiving the John Gaw Meem Award for his thesis on Hispano vernacular architecture. In 1999-2000 Valdez was the recipient of Loeb Fellowship of Advanced Environmental Studies at Harvard University Graduate School of Design. In 2008, Valdez was recognized as a George Pearl Fellow for his work and participation in the UNM Historic Preservation and Regionalism Graduate Certificate Program. As an Adjunct Associate Professor at the University of New Mexico School of Architecture and Planning, he taught courses in alternative materials and methods of construction, cultural landscape planning, Preservation Technologies and Adaptive Reuse. He also co-taught courses on recording historic resources on Route 66 - HABS Measured Drawings, and HAER-acequia documentation for La Cienga and La Bajada Acequias. The courses collaborated with the National Park Service, Santa Fe County and the Graduate Certificate Program in Historic Preservation at UNM.

Currently, Mr. Valdez is owner operator of Rezolana Farm, a Certified Naturally Grown farm specializing in growing heirloom crops/seeds and Industrial Hemp. The farm is irrigated from the Acequia de Cerro and an onsite well.

Craig Cotton, PE

Craig is the Division Engineer for Water Division No. 3 of the Colorado Division of Water Resources, where he manages surface water and groundwater use in the Upper Rio Grande Basin in Colorado. He is also Colorado's Engineer Adviser to the Rio Grande and Costilla Creek compacts. Craig graduated from Colorado State University with a degree in Civil Engineering and has worked for the Division of Water Resources for 27 years. Craig and his wife Cindy live near Monte Vista, Colorado.

James Heath, P.E.

James is the Assistant Division Engineer for Water Division No. 3 of the Colorado Division of Water Resources, where he assists the Division Engineer in serving the public and preserving, protecting, developing, and optimizing the beneficial use of the state's present and future water supplies within the Rio Grande drainage basin according to the principles of the Prior Appropriation Doctrine as established by Colorado law. James graduated from Colorado School of Mines with a degree in Engineering and has worked in the field of water resources for 17 years in both the private and public sectors.

Tom Stewart

Tom is the Lead Water Commissioner for Water Districts 22 and 24 where he and his two deputy water commissioners administer the surfaces water rights in accordance with

Colorado water law and the Rio Grande and Costilla Creek compacts. Tom was raised on a small ranch near Los Sauces Colorado. The Stewart Family has owned this same property for more than 150 years. Tom worked on local farms and ranches until 2004. In April of 2004 he started as a Commissioner in the Saguache area. He has worked in Water District 24 (Culebra and Costilla Drainages) for seven years.

Lucas Casias

Costilla County Noxious Weed Manager

Najondine Placek

Costilla County Chief Deputy Clerk

Chris Rodriguez

Costilla County Land Use administrator

Tim Gordon

Tim Gordon is the CEO for International Hemp Solutions. Tim is known in the hemp industry for his expertise in the field of hemp genetics research and cultivation. He has been part of the CBDRx team for over 18 months. Before being promoted to CEO, Tim served as the CBDRx Chief Agronomist. In addition to his new CEO responsibilities, Tim will continue as Chief Agronomist and oversee CBDRx hemp genetics research and development; all farming operations; and product development.

Russ Orsborn

Russell Orsborn is the Chief Inspector for International Hemp Solutions and will be working to fulfill both Field Inspection and Seed Testing and Certification requirements. He has worked in the Cannabis Industry for several decades in Canada, WA and Colorado. Has been involved in projects that include both indoor and outdoor seed to harvest. Focused on Hemp over the last decade, for both Medicinal and Industrial uses. His interest in hemp and marijuana began when he became a medical cannabis user over 35 years ago, to help with spinal injuries, nerve damage and chronic pain after spending several years in a wheelchair from a motorcycle accident.

Peter Nichols

Peter Nichols practices water law, water quality law, environmental law, and land and water conservation law for the firm of Berg, Hill, Greenleaf and Ruscitti, LLP. In addition to water law and water quality issues; Peter has particular expertise in the federal Clean Water Act and water rights, conservation easements involving water rights, and the temporary use of agricultural irrigation water rights to meet municipal needs. Peter received his JD from the University of Colorado Law School in

2001. Peter is an avid climber, skier and cyclist, as well as a former (and still occasional) international mountaineering guide.

Sarah Krakoff

Sarah Krakoff is the Raphael J. Moses Professor at the University of Colorado Law School. She is the author of law review articles about American Indian tribal sovereignty, climate change, natural resources law, and environmental justice. Professor Krakoff has published in top journals including the Stanford Law Review, California Law Review, and Columbia Law Review, and is the co-editor of a book titled Tribes Land and Environment as well as a co-author of American Indian Law: Cases and Commentary. In addition to her scholarship and teaching, Professor Krakoff frequently writes amicus briefs on behalf of American Indian tribes and environmental non-profits, and runs the Acequia Assistance Project, which provides free legal assistance to low-income farmers in the San Luis Valley of Colorado. Before joining Colorado Law, Professor Krakoff worked for DNA-Peoples Legal Services on the Navajo Nation. She received her JD From U.C. Berkeley Law School and her BA from Yale University.

Gregor MacGregor

Gregor MacGregor is from Boulder County, and spent young summers on family irrigation ditches in the Arkansas Valley. He attended CU as an undergraduate and ROTC Cadet, serving for five years before returning to CU Law. Gregor is currently a Captain in the US Army, and will return to the Army as a JAG after graduation. His legal passions are water and energy law, and he keeps a small garden with his two daughters and wife.

Ron Riggenbach

Ron Riggenbach serves as the Natural Resources Conservation Service (NRCS), District Conservationist for the San Luis Valley. Ron has been with the NRCS for 26 years, where he has overseen a variety of conservation projects. As a San Luis Valley native, Ron understands the diversity of issues that agriculture across the valley faces and is known for helping land owners meet those head-on. As the snow survey lead, he possesses a deep appreciation for water issues faced by SLV producers. Ron graduated from Adams State in 1993, with a degree in Environmental Biology.

NMAA

Focus Article

A framework for assessing ecosystem services in acequia irrigation communities of the Upper Río Grande watershed

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'What we need to do is inventory the different types of agricultural landscapes and bring to light the typical rural architecture, such as the *acequias* and *desagües* (irrigation supply canals and excess water drains). We need to find ways of conserving the landscape, including the flora and fauna as well as the role the agricultural landscape has played in the evolution of the surrounding area. Before we abandon the past (flood irrigation) for the contemporary (drip irrigation), we need a thorough analysis of the pros and cons of each system for the whole cultural landscape. The future may be one where the old and new learn to coexist, such as the hoe with the plow' (Arellano, 2014, p. 204).

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INTRODUCTION

Traditional irrigation systems evolved from the need to bring water to land that produces food. These complex systems, called acequias in Northern New Mexico, are more than simply water delivery systems. In addition to gravity-fed physical infrastructure, acequias are built on knowledge inherent in their linguistic infrastructure,[1] and the ethical practices and spiritual outlook implicit in what can be called their cultural and even spiritual infrastructure.

There is a global concern about the viability of self-organized irrigation systems and their

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durability.[2–4] Acequia-irrigated farms play a decreasing role in direct subsistence in New Mexico.[5–7] With increases in population and economic growth,[8] and changes in water law,[6,9–13] ethnic composition, and property rights regimes, the acequias are facing potential integration into institutions that subordinate them politically and culturally.[6,11,14] Interviews with acequia irrigators in New Mexico show a consistent concern about this issue.[6,15] This subordination could result in a loss of local control over resources, including water.

If traditional agricultural practices and culture are in fact diminishing in New Mexico, it is more important than ever to understand that notions of progress are not always shared.[16] A comprehensive understanding of public welfare is central to addressing this difference in perspective. Researchers should take Leopold's[17] advice about natural systems to heart, and maintain some of the original cogs and wheels of traditional water systems. The acequias are old cogs, well-integrated with the region's hydrology and biology. It would be ignorant to simply throw them away, or to let them disappear without a deeper understanding. As Arellano[18] states, we must examine the costs and benefits of any system of agriculture before changing it wholesale.

The acequias of New Mexico are culturally significant to immediate members of the community, as well as the larger population of the state, visitors to the region, and irrigators and scholars throughout the world.[6,11] While many community members, researchers, and advocates of the acequia communities recognize the important cultural and environmental services of acequias, there is a need to explain and organize them into a conceptual framework that enables researchers to ascertain their contribution to human well-being, or their total economic value.[19–21]

This total economic value includes the market prices of crops or guide services sold and all of the cultural and environmental benefits whose values are not easily determined by a market or existing set of prices. This latter category of benefits is termed 'nonmarket' by economists, as no markets exist to capture their value,[22] and their value is not part of any pricing mechanisms for the sale of water rights out of acequias. Heal et al.[23] state that a failure to include some measure of the value these services will 'implicitly assign them a value of zero' (p. 5).

The assignment of that zero value to these services will result in their being taken less seriously than other services that are easier to value. An example of the problems the absence of these values might create is that water managers might prioritize uses with the highest financial return. It may be tempting to allocate more water for land development projects if current agricultural produce does not generate high enough prices to compete.

Another problem is an insufficient or inaccurate assessment of the public benefits generated by acequia systems. In New Mexico, water rights sales can be legally contested for several reasons.[24,25] One basis for contest is if the transfer is deemed to violate the 'public welfare' of the state.[11,20,26,27] New Mexico water law allows acequia associations to prohibit members from selling their rights if such a sale is deemed to be harmful to the functioning of the acequia.[12,26] Bokum's draft framework for a public welfare regulation suggests that the New Mexico Office of the State Engineer request a benefit–cost analysis for certain water rights sales.

The state of New Mexico has neither a clear definition of public welfare nor any pertinent legislation on the topic as it relates to water. Despite discussion about the public welfare values of acequia irrigation in the state of New Mexico,[11,14,20,26,28] there is still relatively little research on willingness to pay to protect and maintain these systems.[29] From the perspective of economics, willingness to pay is a reliable indicator of the value people hold for resources that lack market prices; it is a measure of public welfare. That willingness to pay should include these nonmarket values, but constructing surveys to ascertain those values would require the establishment of what non market services currently exist.

This research sets out a framework to catalogue and assess the extent and value of ecosystem services[30,31] that occur in the watersheds around northern New Mexican and southern Coloradan traditional irrigation communities.[28,32] These communities form part of what Peña[14,33] calls the Upper Río Grande bioregion (URGB).

Figure 1 provides a map of this area.

We describe these services in a matrix based on a previous ecosystem service framework,[19] but using traditional Spanish terminology for the landscape in which the acequias are found. Topographically, the matrix follows small rivers from their headwaters in the mountains to where they drain into the Río Grande. This is similar to Postel's[34] headwaters-to-sea framework though in a smaller geographical context. The principal contribution of this work is to provide a framework describing what ecosystem services might occur in the acequia landscape, using traditional Spanish terms for the different parts of that landscape.

Costanza et al.[35] examine ecosystem service values in New Jersey, and Raheem et al.[19] examine coastal and marine ecosystem services in California,

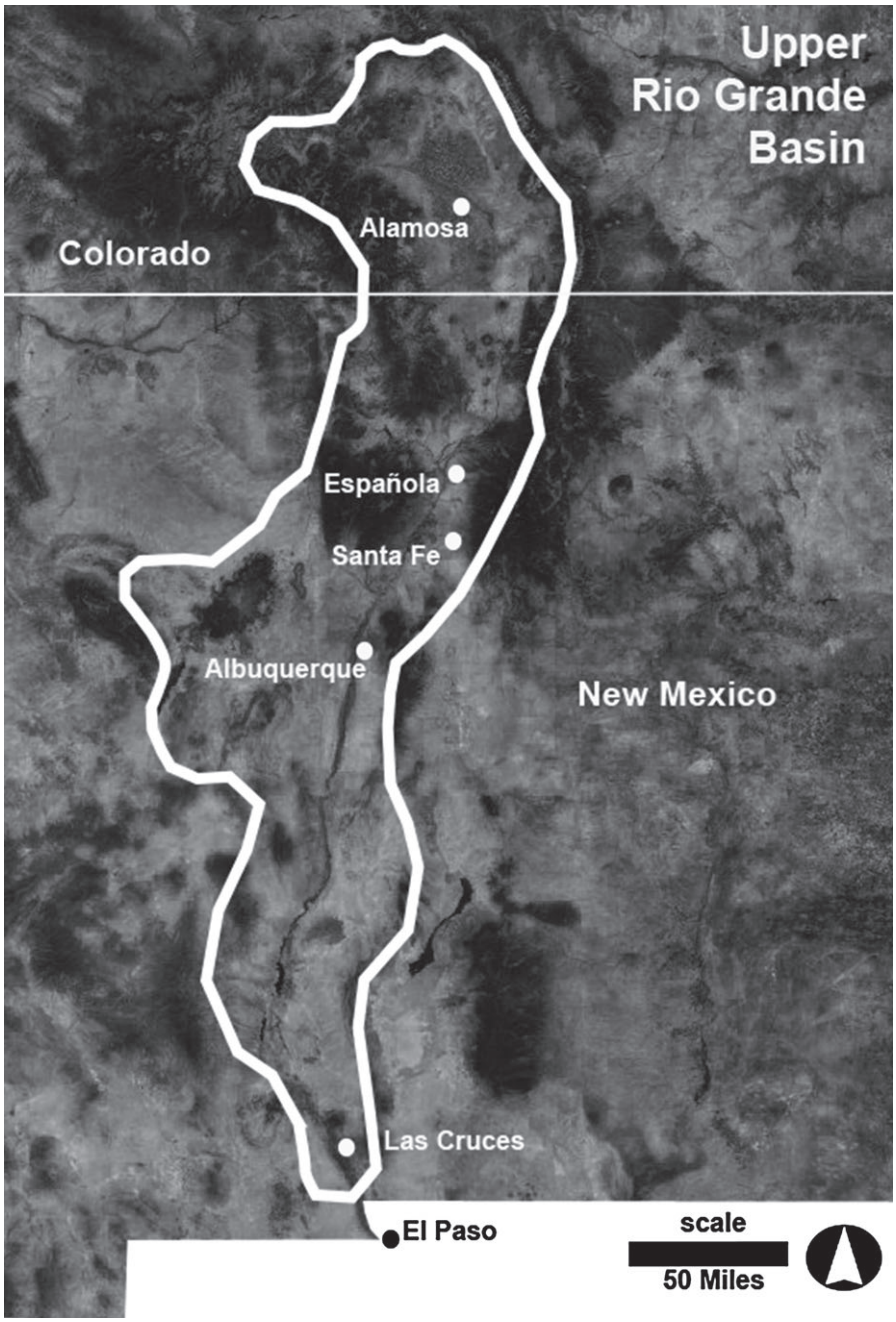

FIGURE 1 | Upper Río Grande watershed.

but little research sets out a structure in which to base regional ecosystem service research and valuation. Much research tends to evaluate a specific ecosystem service in a particular area, or does in fact evaluate several different services.[36] However, ours is one of very few articles to describe in one coherent framework what most or all the services might be in a particular landscape. This should be beneficial to researchers approaching the topic in the future, as the framework is easy to modify and use.

Due to variation in familiarity and use of these terms, our matrix might not be usable in all locations in the URGB, or even northern New Mexico. However, the matrix is reproducible with local terms in any location. The terms are traditional, and citations for them scarce, but the best current sources for descriptions are Arellano,[18] López,[37] and Gonzales.[38] Our effort appears to be the first to create a framework for assessing acequia ecosystem services using traditional Spanish landscape terminology.

ACEQUIAS OF NEW MEXICO

In New Mexico, common-property irrigation ditches are known as acequias, a word deriving from the Arabic *as-saqiya*, meaning water-bearer, irrigation canal, or conduit.[6,11,14,38] Spanish settlers, inheriting Roman and Moorish irrigation systems in southern Spain,[10,39] brought that technology and law to the New World. These systems dovetailed and changed through contact with indigenous irrigation systems in the Upper Río Grande valley.[39,40]

In the late 16th century, Spanish and indigenous settlers from what was then New Spain introduced acequia irrigation methods into the region to establish permanent agricultural settlements, which continued to expand during the 17th and 18th centuries.[41] The settlement of these Spanish villages followed La Recopilación de las Leyes de las Indias that 'established criteria for organizing acequia irrigation systems and the built environment'[42] (p. 894). La Recopilación is known and used especially by older parciantes in many communities, and is described in historical detail in Arellano.[18] It is part of a history of community planning with the framework of the *mercedes* or land grants in New Mexico.

Acequias have supplied water to crops and villages in a high altitude region with scarce, variable water supplies for centuries.[6,43–45] The term acequia carries cultural authority in New Mexico, as not all irrigation ditches are called acequias. In many reaches of the Río Grande, water delivery occurs through canals operated by irrigation districts, including the Middle Río Grande Conservancy District. Ditches in these areas are not technically considered acequias, although many users still use the older term.

Typically the term acequia applies to a community ditch, where there is some extent of communally owned and maintained conveyance or ditchbank easement for access to the ditch. The traditional Spanish term for someone who irrigates from an acequia is parciante, which is not entirely interchangeable with 'irrigator'. Parciante designates a position within a community; one who partakes in the benefits of irrigation but also contributes to its upkeep, and the term signifies a specific relationship to common pool resource management.[6,11] Figure 2 shows the extent of acequias in New Mexico.

Additionally, parciante is used almost entirely in traditionally Hispano communities. Indigenous irrigators, generally English-speaking, would not necessarily call themselves parciantes, and in the United States, the term hardly exists outside New Mexico or southern Colorado. Some interchangeably use the terms irrigators or parciantes, just as some people alternately use acequia or ditch. With a few exceptions, this article uses 'acequias' and 'parciantes' throughout. This is to distinguish them from other, noncommunal or commercial irrigation operations, and also to use the communities' own terminology for themselves. It is increasingly common for both Hispano and non-Hispano irrigators on an acequia to call themselves parciantes. As with any traditional, culturally embedded natural resource management system, some of the terminology is highly local, and its use provides a more accurate picture of the system than would more generic terms.

The land use and cropping patterns of acequia communities take advantage of the unique geography of Northern New Mexico. Acequia settlements along the Río Chama in northern New Mexico, for example, are organized along river corridors that provide the hydrologic flow for acequias to support irrigated agriculture and maintain the cultural landscape of the URGB. Figure 3 shows these settlement patterns.

Traditionally the language spoken in the Indo-Hispano communities of northern New Mexico is Spanish, but that language itself inherits words from Arabic, Nabatean, and the indigenous cultures in the New World with which the Spanish settlers interacted for hundreds of years.[18] In this article, we describe the Spanish terms and provide equivalents in English. For clarity, we avoid using Spanish terminology for all the plant and animal species in our descriptions, though those could be included in field applications.

ECOSYSTEM SERVICES AND AGRICULTURE

Ecosystem services are defined as the benefits that nature provides to humans.[30,31] The Millennium Ecosystem Assessment (MEA), a comprehensive report on the status of ecosystems worldwide commissioned by UN Secretary General Kofi Annan in 2000, outlines four categories of ecosystem services, provisioning (e.g., food, fresh water), regulating (e.g., regulation of climate and erosion), cultural (e.g., spiritual values, recreation), and supporting (e.g., primary production, soil formation). The MEA identifies a linkage between ecosystem services and human well-being, which include but are not limited to security and shelter, access to clean water and nourishment, resources for earning income, energy for keeping warm and cool, good social relations, and freedom of choice and action.

Using a classification framework brings some risk of requiring certain ecosystem services be placed in one category, when clearly there is overlap between categories. Also, a specific category may appear to be missing, particularly as the particular intricacies

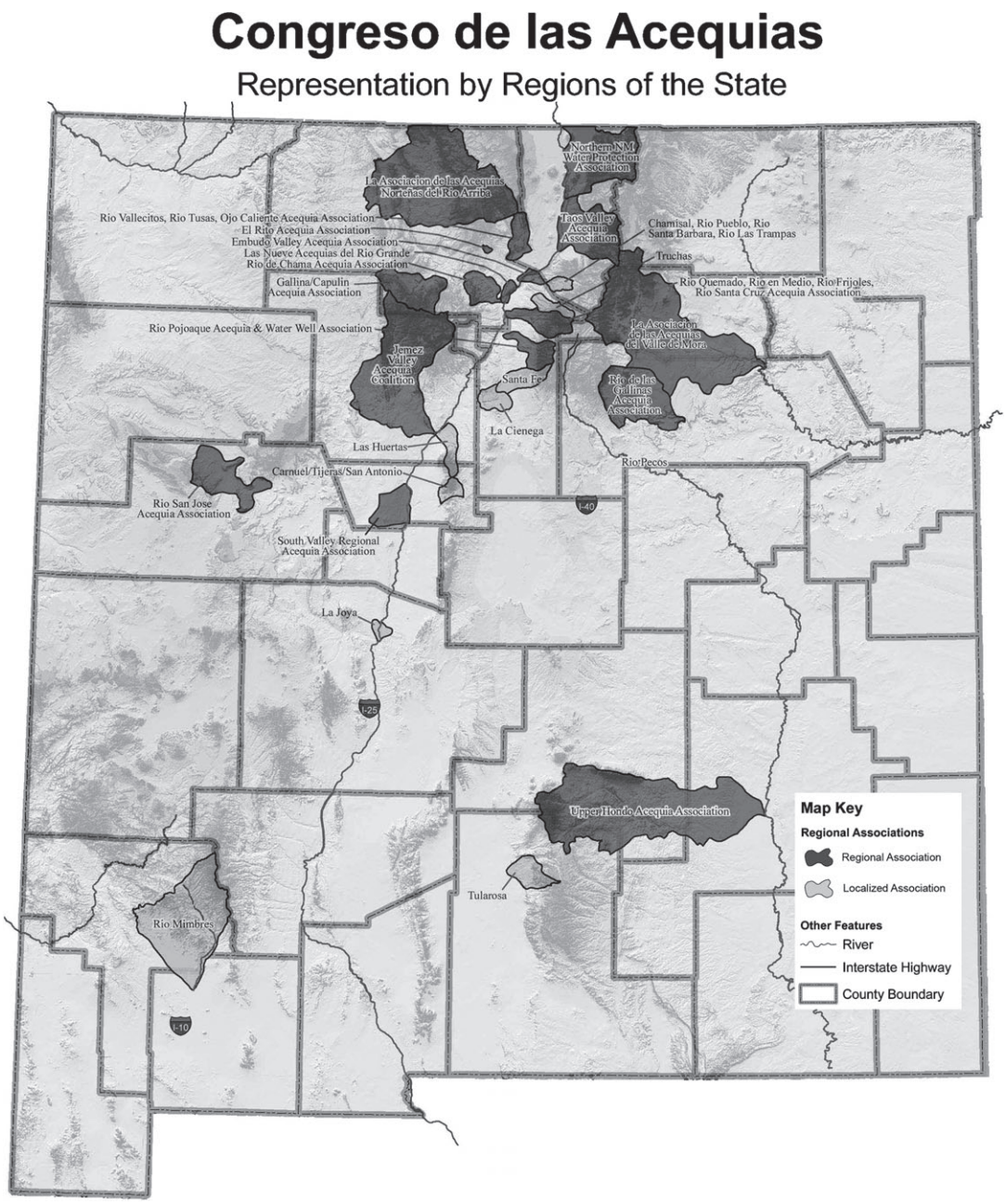

FIGURE 2 | Regional and local acequia associations in New Mexico. (Courtesy of the New Mexico Acequia Association)

of a community or system are investigated. This method, despite its limitations, provides a foundation to discuss the contributions and interconnectedness of acequia ecosystem services, economic value, and human and cultural well-being. There are other frameworks to examine ecosystem services, but we found the MEA classifications to be the most widely recognized and used among different disciplines.

The MEA provides a comprehensive taxonomy of subcategories within each of the major categories of services. For example, in the 'cultural' category, one finds cultural diversity, spiritual and religious values, and knowledge systems as some subcategories. It is then up to researchers to fill in what the 'spiritual and religious values' might be in their particular situation. There is considerable work, for example, on the ecosystem services generated by rivers.[30,46] Table 1 describes some of these services.

Using some acequia-specific examples, local residents could derive benefits from provisioning services when they hunt wild game or gather firewood

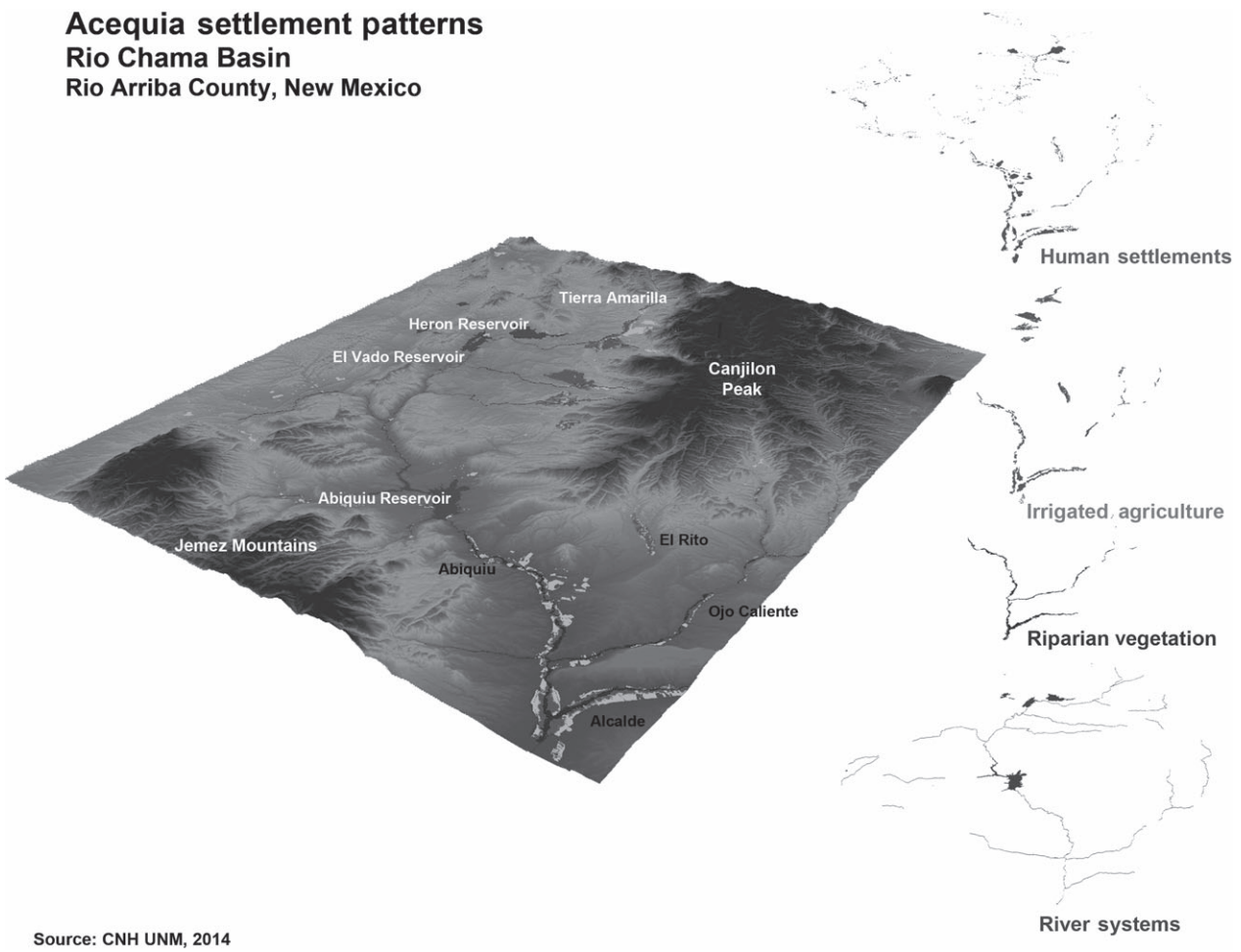

FIGURE 3 | Acequia settlement patterns, Río Chama Basin.

in the uplands, or when they eat fruit from trees grown using irrigation water. Acequias regulate shallow aquifer recharge, and create and regulate microclimates that slow evaporation. The riparian habitat along certain acequias provides regulating services by absorbing the force of floods in the spring and regulate changes in air and water temperature. Acequias and the landscapes they are situated in provide many cultural services, such as the blessing of the waters, the limpia, and the value of historical sites along the river. These cultural services also provide the basis of the social networks that are the very basis of acequia cooperation, management, and governance.

Valuation of ecosystem functions has been addressed for some time by environmental economists. The ecosystem service framework provides a specifically anthropocentric perspective on ecosystem function and aligns the description of that function more with a growing body of literature in ecology.[47] While this difference may seem subtle it is quite powerful. The incorporation of an unabashedly human focus on ecological analysis fits well within formal benefit–cost analysis.[48,49] For any management decision that could have ecological and socioeconomic effects at various scales, ecosystem service valuation could be critical.[47,50–52]

Ecosystem services are not typically associated with anthropogenic, agricultural landscapes, but there is a growing literature on the potential for agriculture to provide ecosystem services. These agroecosystem services include open space,[53–57] wildlife habitat,[58–60] and groundwater recharge.[61,62] This constellation of amenities is also addressed in the agriculture multifunctionality literature.[63–66] Agriculture can also result in ecosystem disservices such as groundwater withdrawal,[67] biodiversity loss and deforestation, primarily in tropical countries.[68,69] Power[70] provides an analysis of agriculture's provision and consumption of ecosystem services.

Ecosystem service research is ongoing in the URGB. Acequia-irrigated farms have been

TABLE 1 | Examples of Riverine Ecosystem Services

Millennium Ecosystem Assessment Category	Specific Services		
Cultural	Traditional knowledge of irrigation and agricultural methods contributing to the function of acequia communities	Appreciation of natural features and wildlife; scenic views	Recreational opportunities
Provisioning	Supply of fish for commercial catch	Supply of water for irrigation or power generation	Supply of other hunted wildlife in riparian areas or in the channel
Regulating	Groundwater recharge through acequia channels and through flood irrigation	Regulation of chemical composition of the atmosphere	Regulation of sediment supply
Supporting	Soil formation processes	Storage, recycling, capture and processing of nutrients	Recovery of nutrients, removal and breakdown of excess nutrients

documented to contribute important ecosystem services including wildlife habitat and groundwater recharge.[14,28,61,62] There are a host of other ecosystem services generated by acequia irrigation and culture, but these have not always been included in ecosystem service-specific research, or corroborated by ecologists and valued by economists.

OBJECTIVES AND METHODS

The first objective of our research was to bring together experts from various fields and disciplines to provide a framework to facilitate regional cataloguing and valuation of acequia-related ecosystem services in the URGB. These experts included a *mayordomo*, (the person who supervises irrigation on an acequia) planners, economists, biologists, horticulturalists, hydrologists, historians, linguists, folklorists, and others who have a deep understanding of the acequia landscape, as well as knowledge of ecosystem service frameworks. This sort of multidisciplinarity is essential to understanding the linkages between ecology and culture.[71,72] This collaborative group is referenced in the first person plural.

The second objective of this research was to base the framework in traditional language. This use of traditional language should make any ongoing research reasonably simple for local respondents, many of whom still use the traditional Spanish terminology for the landforms discussed in this article. Residents and irrigators or land managers in this region often use these terms when describing the landscape. Future efforts of, for instance, community mapping of ecosystem services can use this matrix as a basis for interviewing subjects and cataloguing services. In much the way native subsistence surveys are carried out in the Alaskan Arctic,[73,74] this framework should allow researchers to not only communicate better with the community, but also improve the accuracy of the research instruments through iterative interviews.

Through an intensive 4-day workshop, we identified the principal landform types in smaller watersheds in the URGB in English and Spanish, and then identified which ecosystem services might exist in each of those types. We represent the outcomes of the workshop through a matrix, several graphics, and written material. We built the matrix based on the one found in Raheem et al.,[19] and modified it for a watershed perspective using the traditional Spanish terms for the different dominant landforms. These landform terms are on the horizontal axis, and the ecosystem service subcategories are on the vertical axis. We populated the cells by deciding through conversation and reference to the literature which specific services might exist in those cells.

Some of the Spanish terms we use—*sierra*, *monte*, *jolla*, *vega*, *ciénega*, *bosque*, and *río* (rugged mountain, wooded foothills, hollows, meadow, seasonal marsh, riparian forest, river) have equivalents in English language landscape science. Others—*dehesa*, *cañada*, *banco*, *solar*, *acequia*, *ancon*, *altito-* (grazing land, livestock route or driveway, terrace, irrigation canal, building site, canal, oxbow lands, heights) refer to areas originally or historically designated for a specific agricultural, pastoral, or human habitation use. Those latter terms are found in a range of elevations and biotic communities or life zones, but do not correspond to specific landform terminology in

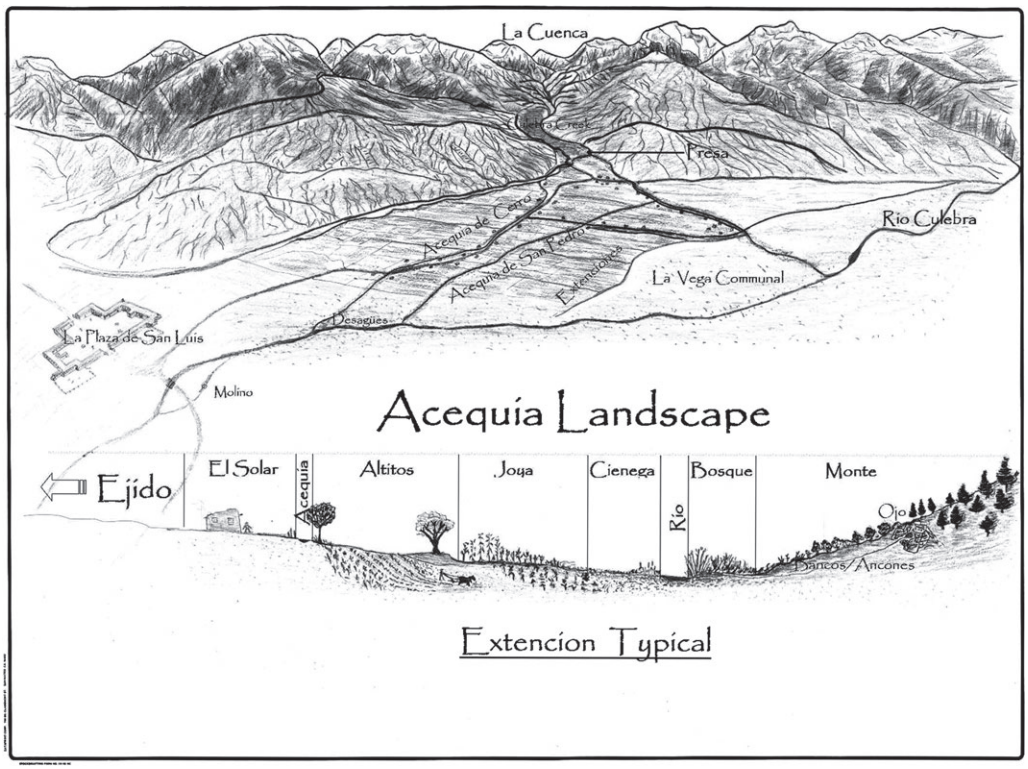

FIGURE 4 | Acequia cultural landscape.

English. In our matrix, we arrange the terminology by decreasing altitude in the *cuenca* (watershed or basin), from the sierras (high peaks) to the río (river). The elevation gradient between the sierras and río also corresponds to transitions in biotic communities. Figure 4 shows a typical acequia agricultural landscape.

The term 'sierras' is roughly equivalent to the alpine and subalpine life zone, typically found above 3660 m (12,000 ft.). Sierra means saw, and the term refers to jagged, rocky, saw-like peaks. Common plant and animal species in this community include bighorn sheep, pika, ravens, different types of lichen, and sedges. The term 'montes', similar to the English 'mountains', refers to less jagged peaks, including wooded foothills.

The montes are roughly equivalent to the forested montane life zone, found between 2440 to 3660 m (8000 to 12,000 ft). In Spanish, the forested region might also be called the *florestas*, a word typically used to denote upland forest. Bosque describes any wooded place, and is often associated with riparian forests and thickets. Common plant and animal species in the higher elevation forests of the montes include blue and Engelmann spruce, Douglas and white fir, aspen, and snowshoe hare. Lower elevations of this zone could include ponderosa pine, Gambel oak, elk, mule deer, turkey, grouse, and Steller's jay. Other terms for this area include mixed conifer down to ponderosa pine forests. Common human uses of the sierras and montes would include the harvesting of wild medicines such as oshá, firewood, wood for carving saints (*santos*), and the hunting of wild animals such as mountain lion, bear, turkey, elk, or mule deer.

Dehesas, cañadas, solares, acequias, altitos, and jollas are all found in foothills ranging in elevation from 1500 to 2440 m (4900 to 8000 ft). Common wild species here could include juniper, jackrabbit, piñón pine, blue grama grass, and western bluebirds. All of these landforms are located in a group of biotic communities including ponderosa to piñón and juniper woodlands, to savanna and grasslands. This is the part of the cuenca that is most intensively used by humans.

Dehesa refers to land that is not irrigated, sometimes common grazing land that surrounds the communities, typically at a higher elevation than human habitation. The dehesa is designated for grazing, but also implies a system of rotation or migration of animals between life zones, e.g., taking cattle and sheep to the florestas in the summer and bringing them back down to lower areas in the winter. In Spain, the dehesas provide passage for long distance

seasonal animal drives, which help to minimize overgrazing in upland pasture. Cañadas are easements or driveways through which animals pass from one zone to another, and often follow drainages and water sources.

Solares are areas specifically set aside for the construction of human habitations. Cultural ecosystem services, such as *Matachines* dancers, feast day celebrations, and other religious processions, are most concentrated in the solares. Altitos are areas typically designated for tree crops, or orchards. Jolla, meaning 'a hollow', refers to the highest quality land for growing—typically irrigated land used for row crops such as corn or chile. Jollas can also be low areas in dry farming where there is more humidity. Ancones are rich bottom lands located between the meanders of a river. A vega is a meadow, or field, but is typically unirrigated. All of the forms described in this paragraph will be present at varying elevations. Altitos will tend to be at a slightly higher elevation than solares, while jollas and ancones will tend to be lower in elevation, closer to streams. The solares themselves are at varying elevations, depending of course on where exactly a village is situated, and can lie above or below altitos, at the same or different elevation from a vega.[18]

The term ciénega means seasonal wetlands and estero means perennial wetlands or marsh, and bosque means riparian forest. Human uses in these communities include birdwatching, gathering willows to make baskets, and harvesting cottonwood roots to make santos and *katchinas*, carved figures representing saints in Catholic culture and spirits in Pueblo culture. Ciénegas, esteros, and bosques are found at a variety of elevations. The Río Embudo, for example, enters the Río Grande at an elevation of about 5600′. The bosques and ciénegas of that particular drainage lie between that elevation and approximately 7000′. Species found in these areas include cottonwood, several species of willow, flycatchers, kingfishers, black bear, beaver, and a variety of fish. Table 2 provides a summary of the landform terminology we describe above.

TABLE 2 | Summary Descriptions of Principal Landform Terminology

Spanish Term	English Equivalent
Sierra	Alpine and subalpine life zone
Monte	Forested montane life zone
Dehesa	Unirrigated, sometimes common grazing land
Solar	Land designated for human habitation
Acequia	Irrigation canal or ditch
Altito	Land typically used for orchards
Jolla	'Hollows', high quality irrigated land for row crops
Vega	Unirrigated meadow. Used for graze crops.
Ciénaga	Seasonal wetland
Bosque	Typically riparian forest
Rio	River/mainstem river

THE MATRIX

The top row of the matrix contains the landform terminology, varying in altitude from highest (Sierras and Montes) to lowest (Ciénegas and Ríos). Each table describes what specific ecosystem services would arise in each of the categories. Our work suggests which services could occur in which landforms, and does not exclude others. Table 4 describes cultural, Table 5 provisioning, Table 6 regulating, and Table 7 supporting. In each table, the left hand column describes the subcategories of ecosystem services for each category.[31] In order to clarify how to read the matrix, Table 3 provides a simplified version of the matrix that describes cultural ecosystem services below.

In Table 3, one can see that several spiritual and religious values occur in the solares. Following the matrix of cultural services, we provide more detailed explanations of the particular uses. Cultural services in this context are the most specific to our work, and the most likely to be unfamiliar to other readers. Reading across the matrix, one sees that values noted cs1, 6, and 10 are found in the solares. Values listed as cs1, 2, 3, and 10 are found in acequias. In the excerpted notes section here, one can find: Matachines, listed as cs1; La Llorona, cs2; Christmas services, cs6; and the blessing of the waters, listed as cs10. What this means is that Matachines dances would take place in the solares *and* near the acequias. La Llorona would exist near the acequias but is *not* listed in the solar region. La Llorona is typically found near or in water bodies, and she is not invoked as living in people's houses. Christmas services would take place in the solares but *not* near the acequias, and the blessing of the waters would take place in both locations.

TABLE 3 | Selected Cultural Ecosystem Services in the Solar and Acequia

Cultural	Solar	Acequia
Spiritual and religious values	(cs1,6,10)	(cs1,2,10)

Spiritual and religious (cs): cs1, Matachines; cs2, La Llorona; cs6, Christmas services; cs10, blessing of the waters.

TABLE 4 | Possible Existence of Cultural Ecosystem Services Provided by Acequia Landscapes in the Upper Río Grande Bioregion

Cultural	Sierra	Monte	Dehesa	Solar	Acequia	Altito	Jolla	Vega	Ciénega	Bosque	Río
Cultural diversity				A							
Spiritual and religious values		(cs9)		(cs1,3,4,5,6,7,8,9,11)	(cs1,2,3,10)					(cs10)	(cs1,11)
Knowledge systems		(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)	(ck1,2,3)
Educational values		(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)	(ce1,2)
Inspiration	A	A	A	A	A	A	A	A	A	A	A
Esthetic values		(ca2,3)	(ca2,3)	(ca1,2,3)	(ca1,2,3)	(ca2,3)	(ca2,3)	(ca2,3)	(ca2,3)	(ca2,3)	(ca2,3)
Recreation and ecotourism	(cr1,2,4,7)	(cr1,2,3)	(cr1,4)	(cr1,8)	(cr1,3,8)	(cr1)	(cr1)	(cr1)	(cr1)	(cr1,2,6)	(cr1,3,5)
Culturally important species[1]	A	A	A	A	A	A	A	A	A	A	A

If the cell is unmarked, no values were designated for that cell. If marked with an A, values are not divided further. If notated other than A, please read explanations as follows: **spiritual and religious** (**cs**): cs1—Matachines, cs2—La Llorona, cs3—feast days, cs4—Penitentes, cs5—Moradas, cs6—Christmas services, cs7—Easter/Semana Santa, cs8—fiestas, cs9—Bultos/Santos, cs10—blessing of the waters; **knowledge systems** (**ck**): ck1—indigenous agricultural knowledge, ck2—flexible resource management, ck3—transmissible knowledge; **educational values** (**ce**): ce1—ecosystem science, ce2—experiential learning; **esthetic values** (**ca**): ca1—social relations, ca2—querencia, ca3—place based environmental ethic, ca4—cultural heritage values; **recreational values** (**cr**): cr1—birdwatching, cr2—hunting, cr3—fishing, cr4—running/biking, cr5—rafting, cr6—horseback riding, cr7—rock climbing, cr8—cultural tourism.
[1]Culturally important species: yet to be determined.

TABLE 5 | Possible Existence of Provisioning Ecosystem Services Provided by Acequia Landscapes in the Upper Río Grande Bioregion

Provisioning	Sierra	Monte	Dehesa	Solar	Acequia	Altito	Jolla	Vega	Ciénega	Bosque	Río
Food	(pf4,5)	(pf4,5,6)	(pf4,6)	(pf1,2,6,7)	(pf4)	(pf1,3,6,7)	(pf1,2,3,6)	(pf3,6)	(pf3,6)	(pf6)	
Fuel	(pfl1,3)	(pfl1,3)	(pfl1,3)			(pfl1)				(pfl1,3)	
Energy					(pe1,pe2)						(pe1,2)
Genetic resources	(pge1,	(pge1,)	(pge1,3)	(pge1,2)		(pge1,2)	(pge1)	(pge1)			
Human habitation	A	A	A	A		A	A	A	A	A	
Human navigation											
Natural medicines	A	A	A	A	A	A	A	A	A	A	
Fiber	(pfb2)	(pfb2)								(pfb1)	
Ornamental resources		A						A	A	A	
Fresh water	A	A					A	A	A		A

If the cell is unmarked, no values were designated for that cell. If marked with an A, values are not divided further. If notated other than A, please read explanations as follows: **food** (**pf**): pf1—fruit trees, pf2—vegetables, pf3—hay crops, pf4—wild plants, pf5—wild animals, pf6—livestock, pf7—bees/hives; **fuel** (**pfl**): pfl1—firewood, pf12—dung fires, pfl3—fuel pellets; **energy** (**pe**): pe1—micro hydro, pe2—mills/molinos, pe3—biomass; **genetic resources** (**pgr**): pgr1—land races of crops, pgr2—drought resistance, pgr3—livestock diversity; **human habitation** (**pgh**): pgh1—building materials (vigas (ceiling beams or joists), latillas (lighter poles or subfloor laid at 90° to vigas), river rock, flagstone, cal, adobe), pgh2—place for building (space), pgh3—shade (reduced cooling cost, pleasant); **human navigation** (**phn**): phn1—footpaths,phn2—bordo, phn3—recreation (jogging, horses, fourwheelers, etc.); **fiber** (**pfb**): pfb1—baskets (willows), pfb2—wool (sheep); **ornamental resources** (**po**): po1—Tamarisk sticks, po2—willow (furniture), po3—natural dyes, po4—carvings from cottonwoods, po5—roots for katchinas, po6—mica clay, po7—mineral dyes and paints, po8—wildflowers, po9—colonial furniture, po10—ristras (wreaths made of chiles), po-11Christmas trees, cedar, pine, po12—leather.

CULTURAL INFRASTRUCTURE AND SERVICES

Acequia communities have their own unique culture and traditions, intertwined with the management of the irrigation system. Many traditional festivities are synchronized with planting, growing, and harvesting seasons, and correspond to related religious beliefs and ceremonies. Layers of traditional knowledge, custom, and practice are invested in this legacy, defined as the 'linguistic infrastructure' of the acequias.[1] The hydraulic culture is likewise derived from a hybrid combination of cultures. This sort of infrastructure, often referred to as 'cultural capital'[75] is found in other irrigation communities worldwide such as those of Bali[76] or Hawai'i,[77] where indigenous and nonindigenous management structures coexist with a particular language, culture, and landscape understanding. Another way to think about it is as part of *querencia*, a term that translates roughly from Spanish as 'love of place'.[1]

The *limpia*, or annual cleaning of the acequia canals, requires the collective participation of all members to be successful. The *repartimiento* or water sharing practices in times of severe drought are based on a traditional moral economy of water articulated

TABLE 6 | Possible Existence of Regulating Ecosystem Services Provided by Acequia Landscapes in the Upper Río Grande Bioregion

Regulating	Sierra	Monte	Dehesa	Solares	Acequia	Altito	Jolla	Vega	Ciénega	Bosque	Río
Air quality			A	A	A	A	A	A	A	A	A
Climate				(rc1)	(rc1)	(rc1)	(rc1)	(rc1)	(rc1)	(rc1)	(rc1)
Erosion	(re1)	(re1)	(re1)	(re1)	(re1)	(re1)	(re1)	(re1)	(re1,2)	(re1,2)	
Water purification/ waste treatment				A	A	A	A	A	A	A	
Disease regulation				A	A	A	A	A	A	A	A
Pollination/seed dispersal				A	A	A	A	A		A	A
Natural hazard regulation				Fire	Fire	Fire	Fire	Fire	Fire	Fire	
Freshwater storage and retention	A	A (rrs1,2)	A (rrs1,2)	A (rrs1,2)	A (rrs1,2)	A (rrs1,2)	A (rrs1,2,3)	A (rrs1,2)	A (rrs1,2,3)	A (rrs1,2)	
Gas regulation	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage	Carbon storage
Invasives regulation				A	A	A	A	A	A	A	A

If the cell is unmarked, no values were designated for that cell. If marked with an A, values are not divided further. If notated other than A, please read explanations as follows: **air quality** (**ra**): ra1—in some instances (urban vs rural); **climate** (**rc**): rc1—microclimate/shade, rc2—macroclimate regulation (carbon storage); **erosion** (**re**): re1—flood control, re2—riparian buffers; **water purification/waste treatment** (**rp**): rp1—wetlands, rp2—dilution of nitrogen from septic systems, rp3—improvements from industrial activities upstream; **disease regulation**: crop diversity cr1, species diversity cr2, insect control/pest management cr3; **pollination/seed dispersal**: bees, birds, all seed eating species; **natural hazard regulation**: flood, fire; **freshwater storage and retention** (**rrs**): rrs1—more storage in drier climate regimes, promotes infiltration, groundwater recharge, river recharge, rrs2—keep río whole, snowpack, water retention and release; rrs3—surface storage; **gas regulation**: water distribution is carbon neutral/negative (gravity-fed systems do not produce carbon due to emissions).

as the 'Right of Thirst' and other principles in ancient Biblical and Qur'anic texts.[6,18] The terms and practice of governance are also culturally based and can be difficult to translate. For example, with its implications of legislative rigor, the English term 'by-laws' is difficult to translate into an acequia context in which a spirit of cooperative flexibility and negotiation is more accurately articulated with terms such as 'arreglos y acuerdos' (settlements and agreements). This is similar to what Lansing[76] describes when discussing the democracy of the *subak* or terraced rice irrigation systems in Bali (pp. 5–6).

In desert and semiarid environments, the very scarcity of water inspires its spiritualization. The central metaphor of 'El agua es vida' (Water is life) informs the rituals of ablution, cleansing, and blessings. The phrase is also popular in acequia community organizing and is a favorite on posters and bumper stickers. In more formal religious settings, water is blessed by priests, and Holy Water is used in the Christian sacrament of Baptism. In the ceremonies of the blessing of waters and water sources, Holy water is mixed with that of springs and acequias. In Pueblo cultures, a repertory of acequia songs and prayers are often a component of practices such as ditch cleaning and irrigating. Cochití Pueblo irrigators recite a spring prayer asking forgiveness from all the insects and living creatures who the artificial diversion of water disturbs. Social acequia cleaning songs such as those recorded in Picurís Pueblo celebrate the fellowship of communal work in a unique combination of syllable (vocable), singing to the percussive accompaniment of rocks struck on shovel blades (as the drums are left behind in the village).

Ethnographic and oral historical sources report a widespread secular water ritual in which an elder can request water from a child, relative or not. The child is obliged to bring a glass or cup of water and reports to the adult, with the formula of 'su agua y su bendición'—'your water and your blessing'. The adult then partakes of the water while the child respectfully stands at attention with arms folded. Then the adult blesses the child. The ceremony teaches respect for water and for elders, and has been reported not only in Hispano and Native communities in the southwest, but in Arabic communities abroad.

The most overt ritualization and syncretization of religious beliefs surrounding water are celebrated in the myriad Indo-Hispano celebrations of the June 24 feast of San Juan Bautista (Saint John the Baptist), the Christian observance of the summer solstice, a popular date to baptize infants. As ubiquitous as the

TABLE 7 | Possible Existence of Supporting Ecosystem Services Provided by Acequia Landscapes in the Upper Río Grande Bioregion

Supporting	Sierra	Monte	Dehesa	Solar	Acequia	Altito	Jolla	Vega	Ciénega	Bosque	Río
Soil formation	A	A	A	A	A	A	A	A	A	A	A
Primary productivity/photo synthesis	A	A	A	A	A	A	A	A	A	A	A
Nutrient cycling	Carbon seq	Carbon seq			Nutrient transport		Green fallow	Green fallow	Nutrient transport	Carbon seq	Nutrient transport
Water cycling	A	A			A			A	A	A	A
Biodiversity conservation	A	A	A						A	A	A
Habitat/refugia	A	A	A	A	A	A	A	A	A	A	A

If the cell is unmarked, no values were designated for that cell. If marked with an A, values are not divided further. If notated other than A, please read explanations as follows: **soil formation**: soil microarthropods, sediment deposition, flood irrigation, decomposition; **primary productivity/photosynthesis**: old growth cottonwoods, pinon, etc., willows, riparian spp, crops, bosque, pasture upland; **nutrient cycling**: carbon sequestration, livestock (p, k, n), nutrient transport, green fallow, composting; **water cycling**: bosque (evapotranspiration), ciénega, bosque restoration (using acequia channels); **biodiversity conservation**: habitat, wetland habitat: high water table, undiscovered spp, aquatic spp, cattails, birds, jumping mouse, managing land practices for habitat restoration.

winter solstice celebrations on December 24, the feast of San Juan celebrates the baptism of John's first cousin Jesus, which ritually recognizes and anoints him as the Christ. Franciscan friars taught that all the waters of the earth are Holy Water on midsummer's feast day, which is celebrated by the practice of ritual bathing shared across cultures. Celebration extends into play. Typically children play in acequias and splash everyone they can. Buckets of water are tossed from balconies, and water is squirted from hoses and thrown in water balloons.

San Isidro Labrador (Saint Isidore the Husbandman) is the patron saint of agriculture whose feast day falls on May 15, which farmers use as a marker date for planting in their particular area. As in other feast days, processions extend blessings from places of worship to the settlements, houses, and fields. Blessings of water are part of these processions.

Themes of water often emerge in the Matachines dance drama, an Indo-Hispano dance that dramatizes the coming of a new religion, Christianity, and the cultural negotiations which precede it. Character names such as Malinche and Moctezuma are reminders of the origins of the dance as a choreographic metaphor for the conquest of Mexico, and the naturalization of the spiritual system in a new cultural context. Many Matachines celebrations cluster around Christmas, but those that observe spring and summer feasts such as San Isidro, San Antonio (June 13), San Juan, and Santiago (July 26) often address water overtly. In some communities, the dancers go in procession from the church to water sources such as springs and rivers to bless them. In others, the saints are removed from the church and go in procession with the dancers to dip their feet in water sources for further blessings.

Rivera et al.[41] discuss the heritage of acequia mutualism connected with the *hermanos penitentes* (penitent brothers in English) and other *cofradías* or confraternities/brotherhoods. The penitentes, formally *La Fraternidad Piadosa de Nuestro Padre Jesús Nazareno*, were a Catholic sect in the region. Chavez[78] describes early US priests' perception of the penitentes as '… societies of men who practiced bloody flagellations and similar tortures during Holy Week and on other occasions' (p. 99). He goes on to state that the penitentes were also '… instrumental in preserving for us, during a most critical period, many old Christian and old Spanish nuggets of virtue, courtesy, and folklore … '(Ref 78, p. 123). The penitentes conducted their rites in chapels known as *moradas*. These moradas were traditionally built, as many structures are in the solares, with local materials. The walls and foundations were built of earthen *adobe* bricks and stones, the ceilings made of wooden *vigas* or beams, crosslaid with *latillas*, or narrow wooden poles that then supported the clay floors. Moradas and other structures were typically plastered with *cal*, a kind of calciferous clay. The table describing provisioning ecosystem services includes these building materials.

Cautionary tales are also one of the cultural services of acequias, as flowing water can be dangerous. The legend cycle of La Llorona is told all over New Mexico and the rest of Mesoamerica. Designed to scare children into avoiding dangerous watery places such as acequias, wells, and beaches, stories of La Llorona or the Weeping Woman connect her sin of infanticide to water, as she typically drowns her children. She takes revenge on their father for rejecting them, a father who typically comes from a higher social group or culture. She is condemned to search

for them for all eternity and her cries are heard near water sources. La Llorona is despised and feared, but people also feel compassion for her. Water is a symbol of both destruction and rebirth, of punishment and redemption. Parents effectively use her to admonish children to stay away from dangerous waters.

DISCUSSION, POLICY APPLICATIONS, AND NEXT STEPS

The use of this framework for decision-making will require mapping the provision and demand of services and assigning value for those services, both within and beyond these systems. This integration may facilitate comparisons between services provided by irrigated agroecosystems and other, natural and human-dominated, landscapes. Economic valuation will also provide values in dollar terms, making comparison between different use scenarios more transparent.

Mapping ecosystem service provision within acequia systems may be accomplished by delineating acequia landforms into a digital GIS coverage. This allows the ecosystem services we identify to be represented in a spatially explicit manner and facilitate comparisons at multiple spatial and temporal scales.[79] To begin this mapping, which is already taking place in several communities, including the Río Embudo watershed, our matrix can be used as part of a community mapping exercise. Asking community members which ecosystem services occur in which landforms, researchers can begin to systematically catalogue the understanding and presence of ecosystem services, and also improve the matrix through local updating of terminology. Additionally, the use of traditional terminology should facilitate building trust between researchers and community members. In this context, our matrix may serve as a survey instrument to illustrate where services produced by the acequia are consumed.[79] For example, a survey distributed throughout an urban center may provide evidence of food consumption from the jolla and thus demonstrate the spatial disconnect between service provision and demand.

These community-generated maps can be correlated with biophysical indicators. Spatially explicit information on land cover—the geographic configuration of different ecosystems—exist for New Mexico at relatively high resolution (e.g., National Gap Analysis Program Landcover Dataset). Relating acequia landforms to vegetation alliances (i.e., landcover types) can facilitate comparisons at multiple spatial and temporal scales.[79] For example, the status of water purification and waste treatment, a regulating service provided by ciénegas, might be estimated on the basis of areal coverage of wetland habitat and percentage impervious surfaces within a given landform. A similar approach has been taken to map ecosystem services associated with biodiversity, a supporting service, for the Southwestern United States.[32]

It is preferable to map and value ecosystem services at the level of the acequia because the benefits of these traditional systems are often unrecognized by broader society.[28] By linking traditional acequia landforms to ecosystem service provision and their biophysical indicators (i.e., landcover) using our matrix, we may also improve our ability to recognize the demand for these services outside the acequia.

Once services are mapped and their status is estimated, it is possible to conduct valuation research related to current status or potential changes in status. Economic valuation can clarify the societal benefits produced by acequia ecosystems and provide a basis for making policy decisions.[80] Different methods of economic valuation are applicable to different ecosystem services.[19,23,80] These methods are broadly classified as revealed and stated preference methods. Revealed preference methods, such as the averting behavior and hedonic price approaches, estimate value using observed household behavior. These methods are primarily used to estimate values associated with the direct and indirect use of environmental resources. In contrast, stated preference methods, such as contingent valuation and choice experiments, are based on household responses to hypothetical scenarios presented in surveys. These methods are better suited to estimating nonuse values associated with preservation and existence, including those related to cultural services.[36,81]

Our matrix offers a frame for prioritizing which ecosystems and ecosystem services are most vulnerable to current management and policy initiatives. Prioritization of ecosystems and ecosystem services will increase the efficiency of credible collection and analysis of data on nonmarket values. In particular, it will help researchers to minimize problems often associated with ecosystem valuation, including double counting and inadequate allowance for substitution effects.[82,83]

There are other approaches as well. Fleming et al.[28] evaluate ecosystem services on two farms in the Upper Río Grande in New Mexico. They use an aggregate scoring method from 1 (poor levels of provision) to 4 (excellent levels of provision) for 16 ecosystem services, including vegetation cover,

vegetation diversity, aquifer recharge, and wildlife diversity. Combining approaches such as Fleming's with in-depth interviews, GIS data on hydrology and biology, and economic valuation could help to improve dramatically the quality of information available for decision-making in acequia communities and at the state or county level.

The language of a culture is bound up in its notions of the order of the world,[76] and to impose a decidedly contemporary western scientific analytical frame on a hybrid Indo-Hispano culture will likely create some confusion. We hope to minimize that confusion for future researchers and participants in research by defining some of the comparable terminology. We also hope that by better representing Spanish terms in the scientific literature, we can also familiarize state agencies with terminology and knowledge that enables them to manage systems with a culturally accurate and sensitive approach. This should also promote the preservation and understanding of the traditional ecological knowledge associated with these terms.

Arellano[18] discusses the richness of the historical legacy from Náhuatl, Moorish, Yemeni, Castilian, and Andean cultures contained in the traditional terminology, not to mention the heritage of the Indo-Hispano communities irrigating the URGB since the early 17th century. Combining the academic expertise of scientists with the first hand, deep cultural knowledge of experienced farmers who are also lore-keepers and community leaders should expand the collective knowledge of these systems.[37] This integration is essential to good relations and good science.[84]

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Sangre de Cristo Acequia Association

El Parciante

PO Box 721 San Luis, CO 81152

The Parciante

Annual
Congreso de las Acequias
Keeping Acequia Traditions Alive

The Sangre de Cristo Acequia Association will be holding their annual Congreso on Saturday, January 20, 2018. The theme for this year's event will be Keeping the Acequia Tradition Alive! The event will host a variety of topics and speakers that are pertinent to acequia irrigators. Topics will include Blessing of the Acequia Waters, Acequia Traditions in a Modern Context, Colorado Water Law and the Acequia, Bylaws and Incorporation: Why or Why not Establish Bylaws, Understanding the New Mexico Acequia's, A Hemp Panel: Understanding the Possibilities of this Crop, and the annual SDCAA meeting.

Doors open at 8:00 am for registration and the Congreso will commence promptly at 8:30. The Acequia Association will be providing a light breakfast and a full lunch for all participates. The Acequia Association will also be giving out door prizes throughout the day and there will be a chance to purchase tickets for a drawing for a rifle, semi-load of wood, and $500 to pay for the annual acequia cleaning. There will also be a variety of vendors present to chat with and get the latest information on a variety of topics.

The Acequia Association will also be hosting a reception on Friday, evening at the Costilla County Conservancy District office at 6:00 pm. Come Learn, Laugh, and Share with other Acequia Parciantes. Light refreshments will be served, and local foods door prizes will be given out. For questions , please contact Mathew Valdez, at 719-672-0810.

This event is made possible by these great Partners and Sponsors: Costilla County Conservancy District, NRCS, San Luis Valley Conservation Fund—the LOR Foundation, Sangre de Cristo National Heritage Area, Colorado Open

Ancient Traditions Keep Desert Water Flowing
By Arturo Sandoval

This section is a portion of an article by Arturo Sandoval in YES Magazine.

New Mexico has spiritual power emanating from the landscape—its rios, mesas, llanos, sierras– that informs our traditional cultures..

Native Americans live each day in a vibrant relationship with everything around them . For them, New Mexico is not just a place to live, It is a way to live.

Similar, Indo-Hispano have created an intimate relationship with the landscape over the past three or four centuries. They built *acequias*– communal irrigation systems.– not only to sustain an agriculture lifestyle, but also to caress and sustain the Earth and its natural creatures.

Acequias evolved over 10,000 years in the desert s of the Middle East and were introduced into southern Spain by the Moors during their nearly 800– year occupation. Spanish colonizers took acequias to the New World. Acequias included specific governance over water distribution, water scarcity plans,

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Acequia Profile:

The Vallejos Ditch

The Vallejos Ditch was established in 1854, priority No. 5 and used for the irrigation of lands and it takes its supply of water from the Vallejos Creek, its head gate is located on the Northbank of the Vallejos Creek about 150 yards above the place where the creek forks, and about 2400 yards above the town of the Vallejos or "Plaza de los Vallejos." The total number of acres irrigated is 1,316.

In 2012, the Sangre de Cristo Acequia Association requested funds in the amount $100,000 on behalf of the Vallejos Ditch Association in order to replace a diversion on Vallejos Creek. Built around 1965, the head gate had surpassed service life.

Commissioner Roy Esquibel and Jonathan Moore, Forsgren Associates Inc.

The concrete structure having deteriorated, which the walls cracked and crumbling. In high flows the headgate failed to divert excess water, causing flooding of the neighboring residential areas. Some of the objectives of the project is to replace the deteriorated Vallejos Ditch Head gate with a new structure, improve downstream water quality, Eliminate greatly reduce maintenance problems, and upgrade water control efficiency for the Vallejos Ditch.

The Vallejos Ditch project was a collaboration with the SdCAA and is an organization built uniting, consolidating, bring together, and supporting the interest of acequia irrigators. They collaborated to collect data and other documents from other agencies.

The parciantes of the Vallejos Ditch can thank the members of the Vallejos Ditch Association and the Mayordomo Augustine Esquibel for there work in the completion of this project.

Ancient Traditions Keep Desert Water Flowing

Continued from page 1

and all other matters pertaining to what was viewed as a communal source. The *mayordomo*, or water master, of the acequia made decisions about water distribution among community members with the consent and advice of the acequia members.

The communal system of irrigating is a response to the scarcity of water in arid regions and was key to the survival of agricultural communities In many instances, the acequia governance system was also used to settle other community conflicts, especially in areas of New Mexico, located far from the seat of government in Mexico City. The irrigation system that evolved over centuries and that was implemented in New Mexico was created to ensure a formal civil process to resolve water-rights issues, especially in dry times. Each irrigator had one vote to elect the mayordomo. The mayordomo had the ultimate authority over water disputes and his word was final. He derived his authority from the communal power vested in him by all the irrigators

In the spring, every able-bodied male was required to show up on the appointed day and to clean and repair the *acequia madre*—

The mother ditch from which each individual plot received irrigation water. The commitment to maintaining the village's primary irrigation supply bonded villagers together over the years . The concept of working communally became an integral part of the village's world view: the group was valued over the individual.

The acequias and other communal traditions in New Mexico and "Southern Colorado Today" demonstrate the positive values that permit us to embrace each other despite our fears and bias. We build on those and root out those negative behaviors that limit our capacity to grow and give.

Sangre de Cristo Acequia Association

The Hallett Decrees and The Rio Culebra Waters

In 1844, the Mexican government presented the grant to Steven Luis Lee, the Governor of Taos, and Narciso Beaubien, the twelve year old son of businessman Carlos Beaubien. Following the Mexican-American War of 1846-48, The United States annexed the area through the Treaty of Guadalupe Hidalgo. The treaty allowed Mexican citizens in the acquired territory to become U.S. citizens if they chose to remain in the United States, and stated the property rights granted or held under Mexican Law would be respected . The grant was confirmed by congress on June 21, 1860.

By 1852, the parciantes, constructed the first Rio Culebra acequia, "the San Luis Peoples Ditch." By the time Rio Culebra became part of the newly formed Colorado Territory in 1861, more than 1700 people lived in the Rio Culebra Watershed and the parciantes had constructed several additional acequias. Not long after the parciantes established the original acequias on the Rio Culebra, Americans with different development ambitions begin to buy land in the area.

After the death of Carlos Beaubien in 1864, William Gilpin, the Governor of the Colorado Territory, purchased the majority of the Sangre de Cristo Land Grant from Beaubien's Estate. Gilpin and his associates attempted to sell the grant. Freehold attempted to settle the grant with immigrants from the East and promoted the area in Europe.

By the 1870"s, San Luis and the surrounding villages were already established. Freehold's plan for Costilla Estates was to build a community and to begin to challenge the claims of the parciantes. The parciantes had settled on the best farmlands and to irrigate these has constructed acequias and appropriated vital water supplies. The challenge pitted the parciantes water rights which they acquired by using the water of the Rio Culebra and it's tributaries which had recognized in 1889, by the Colorado Court applying the prior appropriation doctrine against Freehold's assertion that it's ownership of the Costilla Estates gave it the right to control the Estate waters. After ten years in the courts, Freehold's lawsuit was resolved by a series of consent decrees between Freehold and the parciantes on each acequia. In the decrees, the parciantes agreed to give Freehold a portion of the water rights they had obtained under state law in 1889. These decrees are commonly known as the "Hallett Decrees," After the Hallett Decrees were entered in 1900, Freehold and its successors and the parciantes on the original Rio Culebra acequias fought over whether the decrees were valid, how they should be interpreted, and whether or how Colorado water officials could enforce them. Today, Freehold no longer exists, and the status of the water rights it acquired through the Hallett Decrees is unclear.

To find out more on the Hallett Decrees attend the Congreso de Acequias on January 20, 2018 @ Centennial High School.

Conservancy District to Develop New Watershed Plan

The CCWCD is working to develop a watershed plan to better understand the condition of the Culebra Watershed. Though this plan will be housed at the Conservancy District they are reaching out to the Sangre de Cristo Acequia Association, the Land Rights Council, the Vega Board , Costilla County Commissioners and the new owner of La Sierra. The Conservancy is keenly aware of the need for collaboration and looks forward to working thru this community process.

The Development of the Watershed Plan will consist of 3 phases. The 1st phase will be the Assessment. To assess the drainages, logging area, grazing areas, the geology, the wildlife and fire prevention

The 2 phase will be Management and 3rd phase will be Implementation of the Watershed Plan.

The ultimate goal is to revitalize the watershed, so that more water will be brought down to the acequias and to the river or creeks creating a healthy habitat for those depending on the Watershed.

The Board & Staff

Delmer Vialpando, President
719-672-0944
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Charlie Maestas, Treasurer
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Junita Martinez
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Andy Manzanares
719-588-7607
Dave Marquez
719-672-0334
Mathew Valdez Executive Director
719-672-0810

SdCAA Meeting Dates:

SdCAA Meeting are held the 2nd Tuesday of the Month @ the Economic Development Conference Room.

The SdCAA is looking to fill two (2) vacancies. If you would like to serve on the SdcAA Board, submit a letter of intent to SdCAA, P.O. Box 721, San Luis, CO 81152 or 719-672-0810.

Sangre de Cristo Acequia Association

Sangre de Cristo Acequia Association
401 Church Street – PO Box 721
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The Sangre de Cristo Acequia Association Memorial Scholarship Fund

Following the sudden deaths in 2016 of two valued board members, the SdCAA established a scholarship fund in their honor. Felix Lopez and Joe Gallegos were devoted to acequia traditions and lifeways; they also recognized the importance of both academic and practical education in sustaining the acequia way of life under changing conditions. To continue their work, the scholarship fund will help defray the expenses of college courses as well as internships and practical training. Modest scholarships will be available to parciantes, their family members, and others committed to upholding the acequia traditions. We are currently growing the fund, developing the application process, and defining award criteria. Watch our newsletter, El Parciante, for updates.

Please address contributions to the SdCAA Memorial Scholarship Fund, and mail to PO Box 721, San Luis, CO 81152. We are a 501 c (3) non-profit organization so your donation is tax deductible. The Acequia Association will send you a return receipt acknowledging your donation.

Congreso Board Meeting Agenda

1. Board Introductions

Delmer Vialpando	**President**
Andy Manzares	**Vice President**
Bea Ferrigno	**Secretary**
Charlie Maestas	**Treasurer**
Jaun Ramon Meastas	
Norman Meastas	**Grant Manager**
Dave Marquez	
Junita Martinez	

The Sangre de Cristo Acequias Association can have up to 11 board members, we currently have 8 board active members. Within our by-laws we reserve three board members spaces (one for Conejos, Huerfano and Las Animas acequias respectively).

2. Acequia Office
   The acequia office is located at 401 Church Place, upstairs from the CCEDC Office. Office hours are from 8:00 am to 4:00 pm daily. Our phone number is 719-672-0810.

3. New Executive Director
   The Association through the help of grant funding was able to hire an Executive Director, Mathew Valdez. Let Matt introduce himself and give a bio.

4. Monthly Meeting
   The acequia association holds their regular monthly meeting the second Tuesday of each month. They begin at 7:00 pm during the irrigation season (April-October) and at 6:00 pm during the winter months (November-March). Anyone is invited to attend but all public comment that has not been approved as an agenda item will be limited to 3 minutes.

5. The Mission of the Sangre de Cristo Acequia Association
   The mission of the SdCAA is to ***"To Preserve Acequias, Their Traditional Governance and Water Rights".*** This mission complements the vision of the SdCAA. Which is to preserve acequias in Costilla, Conejos, Huerfano and Las Animas counties as the core social, political and economic institution of their watersheds, and to protect the water rights and unique governance structures that will ensure the viability of the acequia system and the rich ecology, heritage and food production it supports for generations to come.

6. Acequia Association Programs and Projects
   - **Educate** acequia irrigators through a variety of educational programs:
     Congreso de las Acequias – This event is in its 6th year and has helped to increase knowledge about the acequia way of life.
     Landowner Outreach Seminars and Tours – These annual seminars and tours will have three common themes: Water, Crops and Environmental

Preservation. The association realizes the important role that each of each of these plays in the history of the acequia's and the communities they support. The seminars will occur in the spring and the tours during summer and fall. Youth contests and curriculum - The annual coloring, poster and art contest is already in place for area students. The SdCAA is working with partners to develop a curriculum for students.

- **Process**
  The acequia association has done extensive work to update its bylaws, mission statement, websites and landowner database. We have also developed a comprehensive strategic plan that aligns with the outcomes that the association values. At the October 2018 Congreso the SdCAA will hold formal board election for members that will be terming out. Acequias will be contacted to become the member of the SdCAA. Each acequia member will need to select a delegate from their acequia to represent them. Each acequia can only have one delegate and that delegate cannot be a delegate of another acequia. This is why it is important that each acequia assign a delegate, because it will be those delegates who will be able to vote for Acequia Association board members as well as be eligible to become board members of the SdCAA. We are expecting to have 4 open seats. These delegate forms will be going to the Commision of your ditch in mid-February and will need to be returned to the Acequia association by mid-May. Please take time before you leave today to ensure that we have the correct contact information for you and your acequia.
- **Database**
  The acequia Association has developed a database that we are working diligently to update. The purpose of the database is to have current contact information for each acequia. That contact info will help us keep you up to date on upcoming events and opportunities or any threats that we hear about that may need your attention. This information is not sold or used by any one other than the association for this sole purpose of acequia education.

7. Questions?

8. Adjorn