

# EPSCoR Acequias and Climate Change Project, Year 4 Research

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**Introduction** | The Experimental Program to Stimulate Competitive Research (EPSCoR) is funding a study on "Climate Change Impacts on New Mexico's Mountain Sources of Water." Year 4 research is focused on three major elements, which are built upon the culmination of three year's worth of work. The first is to further refine the acequia functionality assessment, which is a tool designed to help acequia farmers rate the resiliency of their local acequia system. The second is to begin to document and quantify the paisajes del agua (irrigated landscapes) and utilize this information to understand how future climate change scenarios may impact cropping patterns. Lastly, a handbook will be created for acequia agriculture communities which will include guidance on how the research from this project can be applied locally.



Acequia headgate (photo: Marcos Roybal)

**Acequia Functionality Assessment** | Acequias currently face a variety of threats. External pressures such as downstream demands for water rights and a changing climate combine with internal challenges such as reduced interest in acequia agriculture to set the stage for an uncertain future for this centuries-old institution. However, no comprehensive tool exists to assess the current conditions of New

Mexico's acequias and the impacts these threats may have upon them. Using the El Rito, NM watershed as a study area, this section of the project is aimed at closing this gap by developing a method of assessing and interpreting factors that contribute to functioning acequia systems.

**Development of the Assessment** | The acequia functionality assessment is based on a riparian health survey method designed by Fleming and Henkel (2001). The riparian survey evaluates 12 criteria that influence riparian health on a scale of one to four, with one corresponding to "poor" conditions and four to "excellent" conditions. The acequia assessment evaluates 22 criteria, which are grouped into categories of physical functionality, ecology, and governance/community use, in a similar manner. These criteria were selected through a combination of a review of the literature, consultation with acequia users and scholars, and field testing.



Field testing the acequia assessment (Photo: Sandeep Sabu)



Northern New Mexico Acequia (Photo: Marcos Roybal)

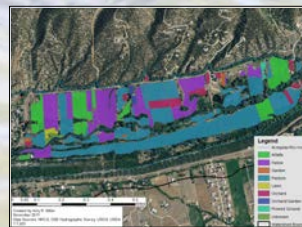
**Use of the Assessment and Future Work** | The assessment can be used to evaluate acequia conditions at a given point in time, monitor changes on an acequia over time, and highlight variability among different acequias. As such, the assessment is intended to provide acequia users with a tool that seeks to identify strengths, weaknesses, and opportunities related to their local acequias. Furthermore, with repeated monitoring, the results of the assessment can be used to infer the effects that factors such as a changing climate or land use shifts are having on acequia systems.

Refinement of the acequia functionality assessment is ongoing. Continued field testing and feedback from acequia users will inform further adjustment. As the assessment is finalized, it will be distributed, with instructions for implementation and analysis of outputs, to acequia users throughout New Mexico. Additionally, Marcos Roybal will detail development of the survey, the theory supporting it, and a case study of its use as his Master's project at the University of New Mexico.

**Documenting the Paisaje del Agua & Cropping Patterns** | The irrigated landscapes acequias create can recharge shallow aquifers, increase ecosystem diversity, and improve water quality (Fernald et al. 2007). These "paisajes del agua" are vital parts of New Mexico's physical and cultural landscapes (Rivera 1998). Documenting cropping patterns (and their changes over time) leads to an understanding of the paisaje del agua and how the landscape has been transformed by acequia agriculture.



**Interpreting Aerial Imagery - 1935 & 2011 - Valdez Area** | Utilizing remote sensing and Geographic Information Systems (GIS), historic and present land uses can be interpreted. In the case of current land uses, ground-truthing of interpreted data would be essential. With this information and information from the hydrographic survey, the paisaje del agua becomes more clear and researchers can begin to quantify the benefits gained by transforming this landscape to beneficial crop production.



**Interpreting Hydrographic Survey Data - 1968 - Valdez Area** | Cropping patterns for this area are already documented in the Rio Hondo hydrographic survey. They are digitally represented here in GIS.

**Next Steps** | Work is continuing on digitizing the Rio Hondo Hydrographic Survey results. Remote-sensing and other techniques will be utilized to understand current and historic cropping patterns. The next major step in research is to begin to quantify the benefits gained from the paisaje del agua - not only from the crops grown but other benefits such as the ecosystem services. Using different climate change scenarios we can begin to speculate on cropping pattern changes with 20-30% less water.

This is a work in progress, so we would love your feedback!  
Copies of the assessment are available on the table.

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**Stakeholder Handbook** | How can this research and analysis be used on a practical level for stakeholders in the Rio Hondo Watershed? The Rio Hondo Stakeholder Handbook will synthesize information and **outcomes** gained in the last several years of this research project. Providing a useful, explanatory guide to the watershed could aid stakeholders at many levels. Whether an acequia user of several generations or a new-comer to the Rio Hondo, the handbook could prove beneficial no matter the level of involvement.

**Applied Synthesis** | The Handbook will be designed to combine a wide range of topics important to the Rio Hondo as well as provide a history of the area. The Handbook will be both a resource for the local community and a celebration of the community. Besides the history of the area, various farms and stakeholders will be highlighted. The Handbook will also provide a source of economic benefits to stakeholders by underlining local resources available in the area. Finally, the Handbook will outline various findings of research applicable to the Watershed as well as demonstrate how that information is valuable and useful to the community.

## Rio Hondo Watershed Stakeholder Handbook

- I. History of Rio Hondo Watershed  
A brief, perhaps one page, history of the area with a focus on the watershed.
- II. Riparian Health Survey  
William Fleming's Riparian Health Survey in an easy to use form for stakeholders and a thorough user guide.
- III. Acequia Functionality  
Marcos Roybal's Acequia Functionality Survey, also with a user guide for stakeholders to work with.
- IV. Acequia User Guide  
This section will have a guide in acequia function, form, and culture, including how to use the acequia system of the area.
- V. User Guide for Allocation Table  
A how to guide for the allocation table in the Flow Share Agreement of 2006 will make up this section.

- VI. Watershed Health 101  
A summary of what a watershed is and all of the variables that go into making and maintaining watershed health.
- VII. Groundwater Importance  
A section covering the unique importance of groundwater in the Rio Hondo area and how it relates back to Acequia Functionality.
- VIII. Effects of Drip vs. Flood Irrigation  
A summary of using drip irrigation versus flood irrigation, including the benefits of each and downsides of each. This section will also include a guide on how to install and use drip irrigation in various forms to make the process more accessible and less intimidating.
- IX. Dryland Farming  
Alternative methods of farming in the arid climates of the Southwest.
- X. Consumptive Use  
This section will explain consumptive use.
- XI. Farms, Crop Distribution and Markets  
An outline of the various crops of the watershed, how they are grown, as well as a highlight of some of the farms (with permission). This section will also cover marketing crops, various ways to make growing more profitable, and highlight all of the farmers' markets in the general area as well as other resources available to farmers.

A working outline for the Stakeholder Handbook

**Further Work** | The Stakeholder Handbook working outline (shown above) will continue to be revised as findings and feedback are incorporated. Further research will need to be done for several of the proposed sections. The handbook will also continue to evolve from current studies that are being done this year, such as examinations of historic and current cropping patterns. Further interviews will also need to be conducted in the community in order to feature community members and farms in the area.

**References** | Fernald, A.G., T.I. Baker, and S.J. Guldán. 2007. Hydrologic, riparian, and agroecosystem functions of traditional acequia irrigation systems. *Journal of Sustainable Agriculture* 30(2): 147-171.

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