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Preview of Award 1010516 - Annual Project Report

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Cover

Federal Agency and Organization Element to Which Report is Submitted:	4900
Federal Grant or Other Identifying Number Assigned by Agency:	1010516
Project Title:	CNH: Acequia Water Systems Linking Culture and Nature: Integrated Analysis of Community Resilience to Climate and Land-Use Changes
PD/PI Name:	Alexander G Fernald, Principal Investigator Jose A Rivera, Co-Principal Investigator Vincent Tidwell, Co-Principal Investigator John L Wilson, Co-Principal Investigator
Recipient Organization:	New Mexico State University
Project/Grant Period:	09/15/2010 - 02/28/2015
Reporting Period:	09/01/2012 - 08/31/2013
Submitting Official (if other than PD\PI):	Alexander G Fernald Principal Investigator
Submission Date:	07/05/2013
Signature of Submitting Official (signature shall be submitted in accordance with agency specific instructions)	Alexander G Fernald

Accomplishments

*** What are the major goals of the project?**

The goals of this project are to understand acequia-moderated linkages between culture and nature and to quantify community survival tipping points. The objective is to quantify the role of acequias in hydrologic buffering, community resilience, and ecosystem health. The **central hypothesis** is that traditional acequias create and sustain intrinsic linkages between human and natural systems that increase community and ecosystem resilience to climatic and socioeconomic stresses. Two sets of linkages are explored: 1) socioeconomic and cultural acequia linkages within and between communities and uplands; and 2) hydrologic acequia linkages between surface water and groundwater in river valleys and contributing watersheds. The working null hypothesis is that stresses from climate change and population growth will have no appreciable effect on the function, performance resilience, and longevity of agro-enviro-social systems of acequia communities.

The following list highlights major outcomes of the project. The cited years represent the expected initiation and completion dates. The ambitious proposed outcomes are realistically obtainable due to ongoing successful team cooperation and infrastructure foundations established by NM EPSCoR. The physical infrastructure developed under NM EPSCoR allows this proposed project to address complex questions at multiple spatial scales without a large investment in equipment and materials. This leveraging of a complementary project enables budget allocation for participants with all expertise needed to complete the major outcomes listed below and described in more detail in the proposal text.

a) A system dynamics decision support system, the Rio Grande Water and Society Simulation Model (RGWSSIM), that will allow simulations of changes in human and natural systems linked by acequia communities. RGWSSIM will operate on a computer and be accessible to community users. Scenarios will consider climate and economic changes as well as stakeholder-defined impacts such as climate and land use on river/riparian function, trade offs among competing agricultural practices, and associated economic/environmental consequences of alternative resource management strategies. Years 1-4. **Ongoing**

b) A model of acequia community economic adaptability and resilience that will provide cutting edge analysis of community economics and resource use. The project will yield entirely new analyses of sociocultural and economic relationships in acequia communities. It will characterize dynamics of changing natural resource use in a multi-cultural setting across multiple temporal and spatial scales. The analysis will address significant recent pressures on acequia communities and provide quantified estimates of community resilience tipping points. The model and analysis will inform the RGWSSIM with functions developed to describe equitable resource sharing and sustainable land use. Years 1-4. **Ongoing**

c) An integrated multi-model and multi-scale approach to studying hydrologic connections between managed agricultural valleys and associated unmanaged forested watersheds. Applied to this unique setting, the suite of models will provide state-of-the-art advances in two areas of hydrologic research: 1) multiple flow path and residence time analysis of surface - subsurface exchange over small to large spatial scales, and 2) ecohydrologic connectivity analysis of managed and unmanaged human and natural landscapes. Water budget and flow path analyses will also be used to parameterize and inform the RGWSSIM. Years 1-4. **Ongoing**

d) Educational programs including K-12, undergraduates, graduate students, teachers, stakeholders and the general public. Younger student efforts will tap into NM EPSCoR programs. This proposed project will support undergraduate and graduate students, importantly at multiple minority serving institutions. Extension service-directed programs and local community group programming will reach community members as will the New Mexico Acequia Association. The general public will be reached by a museum exhibit and a traveling exhibit about multiple human and natural aspects of acequia communities. Years 1-4. **Ongoing**

e) An interdisciplinary modeling workshop applied to the case study of acequia communities linking culture and nature. The workshop will be based on a course offered by project personnel in 2010. The workshop will employ models of many project components in one interdisciplinary approach. Year 2. **100% Completion June 2012**

f) A comparative global perspectives workshop to share and apply understanding of human and natural interactions in similar traditional irrigated communities worldwide. Year 3. **100% Completion March 2013**

g) Integrated on line atlas with maps of human and natural interactions in the upland to irrigated valley continuum and at multiple scales, including the local, valley, and regional scales. These maps will identify communities, water works, wildlife habitat, biodiversity, wildlife corridors, upland vegetation, grazing areas, and hydrology source and sink areas. For policy development, the maps will also show scenarios of these resources due to different impacts mentioned above based on the system dynamics model outputs and the mapping spatial analysis. Years 3-4. **Ongoing**

h) Peer reviewed articles (at least 14 total with two per senior personnel) addressing the different topics investigated in this research effort and participation in local, national, and international meetings for project results dissemination. Years 2-5. **100 % Completion/Ongoing**

Study the Rio Chama basin in Rio Arriba County as a region to test ideas about the coupling of natural and human systems dynamics.

The major goal of this specific component of the CNH Acequia project is to understand the role that small-scale livestock-raising plays in conferring resilience to acequia communities of Northern New Mexico. We seek to assess the conditions and characteristics of small-scale livestock operations and identify livestock-related factors that could trigger future community tipping points.

*** What was accomplished under these goals (you must provide information for at least one of the 4 categories below)?**

Major Activities: The Acequias and the Future of Resilience in Global Perspective Symposium & Workshop was held 2-3, March 2013 in Las Cruces, NM. Approximately 100 registered attendees and students attended both conference days and the workshop held on day 2.

Use of graduate student MS thesis to understand regional effect of climate change and urban growth on biodiversity.

We concluded retrieval of historical information from the U S Forest Service and Bureau of Land Management offices in Taos, NM. Allotment data was obtained for the El Rito, Alcalde and Rio Hondo communities from Grazing and Livestock Use Permit System files (2230), Rangeland Management Planning files (2210), and Permittee files. This historical data spans more than three decades and includes: a) area of home base property; b) season of use; c) grazing period (months or days); d) "in-out" dates for grazing season; e) livestock numbers (actual use and permitted use expressed in Animal Unit Months, AUMs); f) type of livestock; g) number of permit transfers per allotment; and e) reasons for permit transfers and reasons for conversion from one animal type to another (e.g. sheep to cattle, etc.). In addition, we computed stocking rates in Ac/AUM and a composite index relating both rainfall and PDSI to stocking rates. We plan to use this last index to conduct cross-site (i.e. Alcalde, El Rito, Río Hondo/Valdez) and cross-scale (i.e. sites, county, state) comparisons. We are currently conducting statistical analyses of this and previously retrieved county- and state-level data sets.

We also administered a written questionnaire comprising 32 questions divided into three sections focusing on irrigated farming operations, livestock operations, and family traditions and heritage. We attended the annual meeting of the Northern New Mexico Stockman's Association (NNMSA) in Taos in early January 2013 and distribute questionnaires among attendees. Additional questionnaires were handed to community members of El Rito, Alcalde, and Rio Hondo during the months of February and March 2013. Seventy four community members from all three study areas completed the questionnaire.

Trends in survey data are being analyzed and where possible, cross tabulations are being conducted to gain further insight into the data. Preliminary analyses results are reported below.

Specific Objectives: The intent of the Symposium was to pursue a holistic understanding of acequia irrigation in the upper Rio Grande Valley as made up of interactive, interdependent biophysical, economic, ecological, and sociocultural systems.

Develop research monograph on the social-ecological history of the Rio Chama basin to include a narrative report and visualizations across multiple temporal and spatial scales.

Significant Results: Draft of research monograph by UNM graduate students along with mapping inventory was completed in January of 2013. Jose Rivera and Moises Gonzales will edit during spring and summer of 2013.

Preliminary analyses of questionnaire responses received during the NNMSA meeting confirm the central role of livestock-raising in sustaining the economy and traditions of acequia communities of northern NM. In depth analyses of all 74 survey responses received are underway.

Key outcomes or Other achievements: Research article was submitted for publication in a forthcoming special issue of the *Journal of Contemporary Water Research and Education*.

An abstract for presentation at the annual conference of UCOWR/NIWR, June 2013 at Lake Tahoe, was submitted and accepted.

Manuscript in prep detailing regional effects.

*** What opportunities for training and professional development has the project provided?**

A Symposium and Workshop entitled, "Acequias and the Future of Resilience in Global Perspective" was held on March 2-3, 2013 at the Las Cruces Community Center in Las Cruces, New Mexico. It brought together scholars whose perspectives on comparable social-ecological systems in other parts of the world can shed light on the particular and shared features of New Mexican acequias as well as on the challenges they face. The Symposium featured two panels of six CNH Project scholars who reported on their findings and two panels of eight distinguished invited scholars who reported on their research in Spain, Mexico, Peru, Chile, Morocco, Bali, and the United States. The panels were followed by a Roundtable and questions and discussion with the audience. The Workshop, co-sponsored by the new Mexico Acequia Association, featured academic and community scholars as well as activists who addressed questions of research and policy interest. In addition to ten to twenty student walk-ins from NMSU, the event was attended by eighty-seven registered participants, including local farmers and ranchers, scholars, state agency personnel, and other interested members of the public.

Three CNH graduate students were mentored in the production of the narrative and the visualizations. The senior faculty member, Full Professor Jose Rivera, also mentored a junior faculty member, Assistant Professor Moises Gonzales as part of his professional development and tenure track requirements.

One MS level student in the Department of Fish, Wildlife, and Conservation Ecology.

Two MS level students in the NMSU Water Degree Program.

Stephanie Lopez, a Hispanic first generation college student is completing her MS program in Range Science conducting the research associated with this specific objective of the overall CNH proposal. This research will be the core of her MS Thesis.

*** How have the results been disseminated to communities of interest?**

The CNH graduate students presented a research poster at the Congreso de las Acequias, the annual meeting of the statewide New Mexico Acequia Association held in Santa Fe, NM, November 2012.

The oral and Powerpoint presentations from the Global Perspectives Symposium & Workshop have been posted on the Cultural Energy and Water Connections websites.

Biodiversity results have been presented at scientific meetings and the Global Perspectives Symposium & Workshop.

*** What do you plan to do during the next reporting period to accomplish the goals?**

Develop an Acequia exhibit, which will be based on results from the integrated analysis accomplished by the project. The materials from this exhibit will be available for various venues and educational programs located at the museum. Additionally, a smaller, traveling component of the exhibit will be developed by the museum for display in venues in northern and southern parts of New Mexico. The exhibit will show the interconnected futures of upstream and downstream rural and urban populations as linked by acequias. It will also draw on the global communities' workshop perspectives. The museum staff, working with a consultant (Dr. Sylvia Rodriguez) will curate the exhibit, utilizing some materials, such as museum historical photographs. The exhibit will be developed to integrate some facets only touched on in other project components, such as spirituality, sense of place, social movement, governance, and customs of community irrigation systems.

Dr. Rivera will organize Rio Chama workshops for stakeholders in Espanola Valley, El Rito, and Tierra Amarilla to demonstrate qualitative and visualization methodologies for regional water planning.

Dr. Boykin will complete the manuscript on regional effects and work on fine scaled watersheds.

Dr. Cibils plans to conclude statistical analysis of: a) the livestock inventory time series data from allotments surrounding our research areas; and b) survey questionnaire results. Results will be shared with the entire interdisciplinary research group, NM Cooperative Extension County Agents of Taos and Rio Arriba Counties, and other community leaders to obtain multiple perspectives on potential interpretations of observed trends. Data will also be used to inform the systems dynamics model. A first draft of the manuscript reporting results will be available by the end of July 2013. We plan to share results with the community at the 2014 meeting of the Northern New Mexico Stockman's Association and the 2014 Congreso de las Acequias.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Global Perspectives Official Program.pdf	Acequias and the Future of Resilience in Global Perspective Official Program	Alexander Fernald	04/08/2013

Products

Books

Book Chapters

Conference Papers and Presentations

Ochoa, C., and V. Tidwell (2012). *A system dynamics approach for looking at the human and environmental interactions of community-based irrigation systems in New Mexico*. American Geophysical Union Fall, Abstract H23F-1444. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Alexander Fernald (2013). *Acequia Hydrology Foundations of Community Resilience to Changing Climate and Land Use*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Brian Hurd (2013). *Acequia Perspectives on Climate-Change and Population Growth and the Perspectives of Preparedness and Adaptation*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Moises Gonzales (2013). *Climate Connections, Resurfacing Cities of the American Southwest*. Climate Change Town Hall Meeting, New Mexico Sierra Club. Albuquerque, New Mexico. Status = OTHER; Acknowledgement of Federal Support = Yes

Kenneth Boykin (2013). *Ecosystem Services, Faunal Biodiversity and Vegetation Dynamics in Response to Forecasted Land-Use and Climate Change within the Upper Rio Grande*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Arumí, J.L.; Rivera, D.; y Muñoz, E (2012). *Interacciones aguas superficiales y subterráneas en la zona central de Chile*. XI Congreso Latinoamericano de Hidrogeología y IV Congreso Colombiano de Hidrogeología, ALHSUD – ACH. Cartagena de Indias. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Lopez, S., A.F. Cibils, U. Smedly, S. Guldán, and A. Fernald (2013). *Linkages between livestock-raising and acequia irrigation farming in rural communities of northern New Mexico: A preliminary assessment*. 66th Annual Meeting of the Society for Range Management. Oklahoma City, OK. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Ochoa, C.G. and V.C. Tidwell (2012). *Looking at the human and environmental interactions of acequia-community based agriculture systems in New Mexico: A system dynamics modeling approach*. UCOWR/NIWR Annual Conference: Managing water energy, & food in an uncertain world. Santa Fe, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Vince Tidwell (2013). *Modeling the Hydrologic/Ecologic/Economic/Social Dynamics of Small Scale Community Irrigation Systems (Acequias)*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Alexander Fernald; Vincent C. Tidwell; Jose Rivera; Sylvia Rodriguez; Steven Guldán; Caitriana M. Steele; Carlos G. Ochoa; Brian H. Hurd; Marquita Ortiz; Kenneth Boykin; Andres Cibils (2012). *Modeling water, ecosystems, economics and culture in traditional acequia irrigation communities of New Mexico and their linked watersheds*. H14F-03.. AGU Fall Meeting. San Francisco, CA. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Carlos Ochoa (2013). *Monitoring and Modeling Hydrologic Connectivity in Semi-Arid Watersheds*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Moises Gonzales, Jose Rivera (2013). *Qualitative and Visualization Methodologies for Regional Water Planning in the Rio Chama Basin (Abstract)*. UCOWR/NIWR Conference. Lake Tahoe, CA. Status = SUBMITTED; Acknowledgement of Federal Support = Yes

Boykin, K.G., W.G. Kepner, D. F. Bradford, R. K. Guy, D. A. Kopp, A. K. Leimer, E. A. Samson, N. F. East, A.C. Neale and K. J. Gergely (2012). *Quantifying and mapping habitat-based biodiversity metrics within an ecosystem services framework*. ACES and Ecosystem Markets 2012. Fort Lauderdale, FL. Status = PUBLISHED; Acknowledgement of Federal Support = No

José Luis Arumí Ribera (2013). *Society and Hydrology in a Chilean Andean Watershed: How Poor Knowledge of the Hydrological System Produces Social Conflicts*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Ochoa, C.G., K. Gutierrez, A. Fernald, S. Guldan, and S.Yao (2012). *Surface water and groundwater interactions in semiarid irrigated floodplains of northern New Mexico*. 57th Annual New Mexico Water Conference: Hard choices, adapting policy and management to water scarcity. New Mexico Water Resources Research Institute. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

José Rivera (2013). *The Acequia Model: Local Knowledge and Sociocultural Adaptation in the Northern Rio Grande Watershed Commons*. Acequias and the Future of Resilience in Global Perspective Symposium & Workshop. Las Cruces, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Inventions

Nothing to report.

Journals

Alexander Fernald 1,* , Vincent Tidwell 2 , José Rivera 3 , Sylvia Rodríguez 4 , Steven Guldan 5 , Caitriana Steele 1 , Carlos Ochoa 1 , Brian Hurd 1 , Marquita Ortiz 6 , Kenneth Boykin 1 and Andres Cibils 1 (2012). Modeling Sustainability of Water, Environment, Livelihood, and Culture in Traditional Irrigation Communities and Their Linked Watersheds. *Sustainability, Open Access Journal*. 4 (11), 2998-3022. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi:10.3390/su4112998

Arumi, J.L.; Rivera, D.; Holzapfel, E.; Muñoz, E. (2013). Effect of drought on groundwater in a Chilean irrigated valley. *The Institution of Civil Engineers Water Management*. 166 (WMS), 231-243. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: <http://dx.doi.org/10.1680/wama.12.00064>

Boykin, K.G., W.G. Kepner, D.F. Bradford, R.K. Guy, D.A. Kopp, A.K. Leimer, E.A. Samson, N.F. East, A.C. Neale, and K.J. Gergely (2012). A National Approach for Mapping and Quantifying Habitat-based Biodiversity Metrics across Multiple Spatial Scales. *Ecological Indicators*. NA (NA), NA. Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 11.005.

C. G. Ochoa, A. G. Fernald, S. J. Guldan, M. K. Shukla and V. C. Tidwell (2012). Deep Percolation and Water Table Fluctuations in Response to Irrigation Inputs: Field Observations. *New Mexico Journal of Science*. 46 89. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: <http://www.nmas.org/NMJoS-Volume-46.html>

Moises Gonzales, Jose A. Rivera, J. Jarrett Garcia, and Sam Markwell (2013). Qualitative and Visualization Methodologies for Modeling Social-Ecological Dimensions of Regional Water Planning on the Rio Chama.

Journal of Contemporary Water Research and Education (JCWRE). NA (NA), NA. Status = SUBMITTED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: NA

Ochoa C.G., A.G. Fernald, S.J. Guldán, and V.C. Tidwell (2012). Shallow aquifer recharge from irrigation in a semi-arid irrigated Valley in New Mexico, USA. *Journal of Hydrologic Engineering*. 17 (12), 1287-1426. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: doi: 10.1061/(ASCE)HE.1943-5584.0000718

Ochoa, C.G., A.G. Fernald, S.J. Guldán, V.C. Tidwell, and M.K. Shukla (2013). Shallow aquifer recharge from irrigation in a semi-arid agricultural valley in New Mexico. *Journal of Hydrologic Engineering*. NA (NA), NA. Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: NA

Ochoa, C.G., S.J. Guldán, A. Cibils, S. Lopez, K. Boykin, V.C. Tidwell, and A.G Fernald (2013). Hydrologic connectivity of head waters and floodplains in a semiarid watershed. *Journal of Contemporary Water Research and Education*. N/A (N/A), N/A. Status = UNDER_REVIEW; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: N/A

Rango, A., Fernald, A., Steele, C. M., Hurd, B. H., Ochoa, C (2012). Acequias and the effects of climate change.. *Journal of Contemporary Water Research and Education*. NA (NA), NA. Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; OTHER: NA

Steven J. Guldán¹, Alexander “Sam” G. Fernald¹, Carlos G. Ochoa¹, and Vincent C. Tidwell² (2013). Collaborative Community Hydrology Research in Northern New Mexico. *Journal of Contemporary Water Research and Education*. N/A N/A. Status = AWAITING_PUBLICATION; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes

Villarreal, M.L., L.M. Norman, K.G. Boykin, and C.S.A. Wallace (2013). Biodiversity losses and conservation trade-offs: assessing future growth scenarios for a North American transnational trade corridor. *International Journal of Biodiversity Science, Ecosystem Services & Management*. NA (NA), NA. Status = PUBLISHED; Acknowledgment of Federal Support = Yes ; Peer Reviewed = Yes ; DOI: 10.1080/21513732.2013.770800

Licenses

Nothing to report.

Other Products

Databases.

CNH Acequia Drop Box is a secured web-based external repository that allows invited project participants efficient access to all data and information relevant to the CNH project

Databases.

CNH Acequia FTP Site houses and allows transfer of large amounts of raw data or items with a higher level of security than is available with the CNH Acequia Dropbox

Databases.

Raw data is currently being collected in an internal excel spreadsheet. Once this data is verified and converted to a uniform unit of measure, it is then uploaded to an internal access database. This data is used by the project researchers for their project work. As some of this data is sensitive to the project, not all is currently available to our project stakeholders or the general public.

Data that has been verified is available in real time on our project website : Water Connections (waterconnections.org). This data is readily available to our stakeholders and the general public.

Physical Collections.

The Acequia Manual contains pictures, maps, site descriptions, and contact information for the El Rito and Rio Hondo Valleys. It is located in the CNH Acequia Dropbox and is available to all invited participants.

Audio or Video Products.

Both audio and video were taken during the Global Perspectives Symposium & Workshop held March 2-3, 2013. This was a joint effort between Robin Collier of Cultural Energy and Patrick Hemp of NMSU. These presentations are available at Cultural Energy's website and our project website: waterconnections.org.

Models.

Currently work is being done to create a System's Dynamic Model that incorporates a multiperspective model for sustainability of water, environment, livelihood, and culture in traditional irrigation communities and their linked watersheds.

Information about this model is available in publications and is disseminated in outreach efforts. Causal loop diagrams will be made available on the project website: waterconnections.org.

Educational aids or Curricula.

E. Samson, **K.G. Boykin**, W.G. Kepner, D.F. Bradford, A.K.K. Leimer, D. Kopp, F. East, R.K. Guy. 2012. Comparison of biodiversity response to forecasted land-use and climate change within 3 watersheds in the Southwest United States. 19th Annual Conference of The Wildlife Society, October 13-18, 2012, Portland, OR. (Poster is attached)

Educational aids or Curricula.

Lopez, S., A.F. Cibils, U. Smedly, S. Guldan, and A. Fernald. 2013. Linkages between livestock-raising and acequia irrigation farming in rural communities of northern New Mexico: A preliminary assessment. 66th Annual Meeting of the Society for Range Management. Oklahoma City, OK, Feb. 3-7, 2013. (a pdf of the poster is attached)

Other Publications

Sylvia Rodriguez (2014). *Acequia Activism and Collaborative Research*. The topic is "Acequia Activism and Collaborative Research," and will touch on the emergence of acequia activism since around 1980 as well as multidisciplinary scientific research (CNH/NMSU "Acequia Water Systems Linking Culture and Nature: Integrated Analysis of Community Resilience to Climate and Land Use Changes") and community-based participatory action research (NMAA Mayordomo Project) now being carried out on acequias. An invited speaker as part of Amigos Bravos "Water Matters" Lecture Series in Santa Fe, NM. Status = PUBLISHED; Acknowledgement of Federal Support = Yes

Patents

Nothing to report.

Technologies or Techniques

Nothing to report.

Thesis/Dissertations

Elizabeth Samson. *Evaluating Biodiversity Metric Response to Forecasted Climate and Land-Use Change in the American Southwest*. (2012). New Mexico State University. Acknowledgement of Federal Support = Yes

Websites

Acequias and the Future of Resilience in Global Perspective

<http://globalperspectives2013.wrri.nmsu.edu/>

This symposium pursues a holistic understanding of acequia irrigation in the upper Rio Grande Valley as made up of interactive, interdependent biophysical, economic, ecological, and sociocultural systems. It brings together scholars whose perspectives on comparable social-ecological systems in other parts of the world can shed light on the particular and shared features of New Mexican acequias as well as on the challenges they face. Of special interest are questions about whether and how local common resource pool management can maintain or regain resilience under conditions of accelerating integration into a global economy and climate change.

CNH: Acequia Water Systems Linking Culture and Nature

<http://aces.nmsu.edu/cnhacequia/>

In arable valleys of water-limited regions worldwide, community water management systems have evolved to sustain communities in the face of unreliable precipitation. The acequias of the southwestern United States are community irrigation systems that are based largely on ancient technology introduced to the region by 16th-century settlers. Acequias consist of gravity-fed earthen canals that divert stream flow for distribution to fields. They lie at the center of a set of complex self-maintaining interactions between culture and nature that appear to enable drought survival and maintain other sociocultural and ecosystem benefits. Local water management groups inherent in acequias ensure equitable distribution of water to each community, allocating less water for all users in dry years and more in wet years. Acequias help maintain community identity and cohesion, economic sustainability, enhanced floodplain hydrologic function, and wildlife habitat. Contemporary acequia-based communities face new socioeconomic and natural resource pressures that threaten their existence, however. Population growth is accelerating the change from agricultural to residential land and water uses, while climate change threatens to bring warmer winters with less precipitation and earlier spring snowmelt. Traditional acequias create and sustain intrinsic linkages between human and natural systems that increase community and ecosystem resilience to climatic and socioeconomic stresses. Greater knowledge about these interconnections and what can cause them to change or fail will be essential to determine how the communities relying on acequias can adapt to changing conditions. This interdisciplinary research project will explore socioeconomic and cultural linkages within and between acequia communities and associated landscapes; hydrologic linkages between surface water and groundwater in irrigated river valleys and contributing watersheds; and wildlife habitat and grazing distribution connections between valley riparian areas and upland forests and grasslands. The investigators will quantify the role of acequias in hydrologic function, community resilience, and ecosystem health, and they will identify potential tipping points for acequia community survival. Integrative tools informed by examinations of socioeconomic, cultural, and ecohydrological factors will indicate the resilience level of acequia-centered systems. A system dynamics model will simulate effects of climate and land-use stressors on relationships between economic, social, cultural, climatic, hydrologic, vegetation, and wildlife components. The model will quantify the magnitude of stressors needed to undermine community and ecosystem resilience. Mapping will capture spatial linkages and help communicate the findings to a larger audience.

This project will provide new insights into the relationships between traditional water management systems, communities, and landscapes. It will broaden participation of minorities by conducting research in rural Hispanic communities. Community members will be active participants in the project and help determine keys to their own community survival. Project results will be made available to researchers, policy makers, local stakeholders, and the general public through scientific publications, presentations, extension documents, and workshops. Teachers from the region will be involved in participatory training in order to reach K-12 students. Undergraduate students will be directly involved in the research, as will graduate students who will be trained as future scientists and community leaders. A major museum exhibit will integrate spirituality and sense of place into presentation of community resource governance. Cross-pollination of ideas with international experts will take place through a global comparative workshop and a comparative study in Chile. Policy guidance resulting from this study should help maintain acequia communities and similar common-pool resource systems worldwide.

Surface Water - Groundwater Interactions in Irrigated Floodplains in Northern New Mexico

<http://aces.nmsu.edu/academics/waterresearch/index.html>

Along irrigated cropland corridors between irrigation ditches and rivers, potential water quantity and water quality benefits of ditch seepage and irrigation deep percolation may derive from the close interaction between surface water and shallow groundwater.

Insufficient data exist to fully characterize the hydrological effects of ditch seepage and irrigation deep percolation in these irrigated corridors.

In order to advance scientific understanding and improve water resources management, our research integrates study of surface water and shallow groundwater to characterize hydrological processes in irrigated cropland corridors along the Rio Grande in northern New Mexico.

Water Connections

<http://www.waterconnections.org/>

A website dedicated to water research connecting human and natural landscapes.

Supporting Files

Filename	Description	Uploaded By	Uploaded On
Samson_TWS_2012_3 poster.pdf	Comparison of biodiversity response to forecasted land-use and climate change within 3 watersheds in the Southwest United States Elizabeth Samson, Kenneth G. Boykin, William G. Kepner, David F. Bradford, Allison K.K. Leimer, Darin Kopp, Forrest East, Rac	Alexander Fernald	05/01/2013
SRM 2013_ Acequia Poster_Final Compatibility Mode.pdf	Lopez, S., A.F. Cibils, U. Smedly, S. Guldan, and A. Fernald. 2013. Linkages between livestock-raising and acequia irrigation farming in rural communities of northern New Mexico: A preliminary assessment. 66th Annual Meeting of the Society for Range Manag	Alexander Fernald	05/17/2013

Participants/Organizations

What individuals have worked on the project?

Name	Most Senior Project Role	Nearest Person Month Worked
Fernald, Alexander	PD/PI	4
Fernald, Alexander	PD/PI	4
Rivera, Jose	Co PD/PI	2

Name	Most Senior Project Role	Nearest Person Month Worked
Tidwell, Vincent	Co PD/PI	2
Guldan, Steve	Co-Investigator	4
Arumi, Jose	Faculty	1
Boykin, Kenneth	Faculty	2
Cibils, Andres	Faculty	2
Gonzales, Moises	Faculty	1
Hurd, Brian	Faculty	1
Pullin, Michael	Faculty	1
Rango, Al	Faculty	1
Rodriguez, Sylvia	Faculty	4
Shukla, Manoj	Faculty	1
Elias, Emile	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Frisbee, Marty	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Ochoa, Carlos	Postdoctoral (scholar, fellow or other postdoctoral position)	4
Steele, Caitriana	Postdoctoral (scholar, fellow or other postdoctoral position)	1
Garcia, Paula	Other Professional	1
Hemp, Patrick	Other Professional	1
Howard, Clifford	Other Professional	1
Ortiz, Marquita	Other Professional	2
Romanek, Devorah	Other Professional	1

Name	Most Senior Project Role	Nearest Person Month Worked
Dunlap, Robbie	Technician	6
Cozzens, Brian	Graduate Student (research assistant)	1
Garcia, Jarrett	Graduate Student (research assistant)	2
Gutierrez, Karina	Graduate Student (research assistant)	4
Harding, Jevon	Graduate Student (research assistant)	1
Lopez, Stephanie	Graduate Student (research assistant)	1
Lopez, Alejandro	Graduate Student (research assistant)	4
Markwell, Sam	Graduate Student (research assistant)	2
Samson, Elizabeth	Graduate Student (research assistant)	1
Thompson, Sophia	Graduate Student (research assistant)	2
Tolley, Douglas	Graduate Student (research assistant)	1
Tsinnajinnie, Lani	Graduate Student (research assistant)	1
Williams, Tristan	Graduate Student (research assistant)	1
Fossberg, Bobbie	Non-Student Research Assistant	6
Boyko, Kevin	Undergraduate Student	6

Full details of individuals who have worked on the project:

Alexander G Fernald

Email: fernald@nmsu.edu

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 4

Contribution to the Project: PI and overseer of CNH Acequia Project and Team Members. Attended IWG meeting 2011. Coordinating Instructor for the RGSC 618 Interdisciplinary Modeling: Water-Related Issues and Changing Climate course held at NMSU, June 4th-15th, 2012. Global Perspectives Symposium & Workshop coordinator, host, and speaker. March 2-3, 2013

Funding Support: Tri-State EPSCoR, NM EPSCoR

International Collaboration: Yes, Chile

International Travel: Yes, Chile - 0 years, 0 months, 14 days; - 0 years, 0 months, 0 days; - 0 years, 0 months, 0 days

Alexander G Fernald

Email: fernald@nmsu.edu

Most Senior Project Role: PD/PI

Nearest Person Month Worked: 4

Contribution to the Project: PI and overseer of CNH Acequia Project and Team Members. Global Perspectives Symposium & Workshop coordinator, host, and speaker. March 2-3, 2013

Funding Support: Tri-State EPSCoR, NM EPSCoR

International Collaboration: Yes, Chile

International Travel: Yes, Chile - 0 years, 0 months, 14 days

Jose A Rivera

Email: jrivera@unm.edu

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Served as Co-PI of NSF grant to NMSU and as the PI of a subaward from NMSU to UNM. Supervised work of graduate students. Global Perspectives Symposium & Workshop speaker, March 2-3, 2013. Global Perspectives Workshop Co-chair, March 3, 2013.

Funding Support: Tri-State EPSCoR, NM EPSCoR

International Collaboration: Yes, Chile, Spain

International Travel: No

Vincent Tidwell

Email: vctidwe@sandia.gov

Most Senior Project Role: Co PD/PI

Nearest Person Month Worked: 2

Contribution to the Project: Leading Integrated Modeling Effort. Travel and support of Post-Doc. Because of employment at Sandia, funding for participation is limited. Global Perspective Symposium & Workshop speaker, March 2-3, 2013

Funding Support: Tri-State EPSCoR, NM EPSCoR

International Collaboration: Yes, Chile

International Travel: No

Steve Guldán

Email: sguldán@nmsu.edu

Most Senior Project Role: Co-Investigator

Nearest Person Month Worked: 4

Contribution to the Project: Takes lead on AES and CES outreach publications. Coordinates assistance of Alcalde staff on some aspects of field work. Presents project objectives and results as needed at meetings and when giving tours at the Alcalde Science Center. Global Perspectives Symposium & Workshop moderator, March 2-3, 2013.

Funding Support: none

International Collaboration: Yes, Chile

International Travel: No

Jose Arumi

Email: jarumi@udec.cl

Most Senior Project Role: Faculty

Nearest Person Month Worked: 1

Contribution to the Project: Dr. Jose Luis Arumi is currently starting the project 'Water availability in a stressed Andean watershed in Central Chile: Vulnerability under climate variability', funded by the Chilean Sciences Council (Fondecyt) that can be used as a parallel Chilean research project The creation of a new Water Center will provide the basis of future collaboration between the Acequia Team, the Chilean partners and the Chilean canal users. Global Perspectives Symposium & Workshop speaker, March 2-3, 2013.

Funding Support: Support from his home university

International Collaboration: Yes, Chile

International Travel: Yes, United States - 0 years, 0 months, 7 days

Kenneth Boykin

Email: kboykin@nmsu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Lead personeel overseeing graduate student and participating in project scoping and modeling. Global Perspectives Symposium & Workshop speaker, March 2-3, 2013.

Funding Support: Tri-State EPSCoR, NM EPSCoR

International Collaboration: Yes, Chile

International Travel: No

Andres Cibils

Email: aciblis@nmsu.edu

Most Senior Project Role: Faculty

Nearest Person Month Worked: 2

Contribution to the Project: Global Perspectives Symposium & Workshop moderator, March 2-3, 2013

Funding Support: none

International Collaboration: Yes, Chile

International Travel: No

Moises Gonzales**Email:** mgonzo1@unm.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Faculty Mentor, Center for Raza Planning, School of Architecture and Planning, University of New Mexico.**Funding Support:** Tri-State EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No**Brian Hurd****Email:** bhurd@nmsu.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Lead personnel regarding Socio-Economic Assessment and Analysis. Global Perspectives Symposium & Workshop speaker, March 2-3, 2013**Funding Support:** none**International Collaboration:** No**International Travel:** No**Michael Pullin****Email:** mpullin@nmt.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Project participant-UROP coordinator**Funding Support:** none**International Collaboration:** No**International Travel:** No**Al Rango****Email:** alrango@nmsu.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1**Contribution to the Project:** Related through EPSCoR Project**Funding Support:** EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No

Sylvia Rodriguez**Email:** sylrodri@unm.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 4

Contribution to the Project: Consultant with UNM. Lead coordinator for Global Perspective Symposium and Workshop held in Las Cruces, NM, March 2-3, 2013. Lead coordinator for Acequia exhibit to be showcased at Maxwell Museum in 2014 and traveling exhibit.

Funding Support: none**International Collaboration:** Yes, Chile, Mexico, Morocco, Spain**International Travel:** No**Manoj Shukla****Email:** shuklamk@nmsu.edu**Most Senior Project Role:** Faculty**Nearest Person Month Worked:** 1

Contribution to the Project: Worked with Dr. Ochoa in creating publications, poster, and conference presentations that relate to the CNH Acequia grant.

Funding Support: none**International Collaboration:** No**International Travel:** No**Emile Elias****Email:** eliaseh@nmsu.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 1

Contribution to the Project: Assiste with database management and modeling effort.

Funding Support: NM EPSCoR**International Collaboration:** No**International Travel:** No**Marty Frisbee****Email:** mfrisbee@alumni.nmt.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 1

Contribution to the Project: Post-Doc on the NM EPSCoR project.

Funding Support: NM EPSCoR**International Collaboration:** No**International Travel:** No

Carlos Ochoa**Email:** carochoa@nmsu.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 4**Contribution to the Project:** Collects and provides research information dealing with New Mexico Acequias. Global Perspectives Symposium & Workshop speaker, March 2-3, 2013**Funding Support:** Tri-State EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No**Caitriana Steele****Email:** caiti@nmsu.edu**Most Senior Project Role:** Postdoctoral (scholar, fellow or other postdoctoral position)**Nearest Person Month Worked:** 1**Contribution to the Project:** Spatial data creation, compilation and GIS support.**Funding Support:** Tri-State EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No**Paula Garcia****Email:** lamorena@lasacequias.org**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 1**Contribution to the Project:** Related through New Mexico Acequia Association. Invited panelist for Global Perspectives Workshop, March 3, 2013.**Funding Support:** NMAA**International Collaboration:** No**International Travel:** No**Patrick Hemp****Email:** phemp@nmsu.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 1**Contribution to the Project:** Responsible for website creation and management for the CNH Water Connections and Global Perspectives websites. Assisted with all computer details and presentations during Global Perspectives Symposium & Workshop, March 2-3, 2013.**Funding Support:** none**International Collaboration:** No**International Travel:** No

Clifford Howard**Email:** clhowar@sandia.gov**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 1**Contribution to the Project:** Assisting with Integrated Modeling effort.**Funding Support:** none**International Collaboration:** No**International Travel:** No**Marquita Ortiz****Email:** quita@lasacequias.org**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 2**Contribution to the Project:** Provides acequia expert input and survey involvement with Dr. Hurd and Dr. Rivera. Collaborating on coordination of Socio-Cultural focus group. Global Perspectives Workshop Co-char, March 3, 2013.**Funding Support:** NMAA, Tri-State EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No**Devorah Romanek****Email:** dromanek@unm.edu**Most Senior Project Role:** Other Professional**Nearest Person Month Worked:** 1**Contribution to the Project:** Ethnology Curator for the Maxwell Museum at UNM in Albuquerque, NM. Will be assisting with the CNH Acequia exhibit.**Funding Support:** UNM, NM EPSCoR**International Collaboration:** No**International Travel:** No**Robbie Dunlap****Email:** oryxman2003@gmail.com**Most Senior Project Role:** Technician**Nearest Person Month Worked:** 6**Contribution to the Project:** Field Technician that worked in Northern New Mexico gathering data and assisting graduate students. Left the program Spring of 2013**Funding Support:** NM EPSCoR**International Collaboration:** No**International Travel:** No

Brian Cozzens**Email:** bcozzens@nmt.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Hydrologic data and model construction; also supported by NM EPSCoR**Funding Support:** NM EPSCoR**International Collaboration:** No**International Travel:** No**Jarrett Garcia****Email:** Jarrett1@unm.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 2**Contribution to the Project:** Lead responsibility for the creation of GIS maps for the Rio Chama Basin in Rio Arriba County of New Mexico under the supervision of Faculty Mentor, Moises Gonzales.**Funding Support:** NSF/RA**International Collaboration:** No**International Travel:** No**Karina Gutierrez****Email:** kgutier@nmsu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 4**Contribution to the Project:** Assisting Dr. Fernald with data research in Northern New Mexico for CNH project and graduate work.**Funding Support:** Tri-State EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No**Jevon Harding****Email:** jharding@nmt.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** NMT Student and RA. Hydrologic data and model construction; also supported by NM EPSCoR.**Funding Support:** NM EPSCoR**International Collaboration:** No**International Travel:** No

Stephanie Lopez**Email:** lopez@nmsu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1

Contribution to the Project: Conducting a literature review and a guided study on Rural Sociology in preparation for survey design. Assisted with Global Perspectives Symposium & Workshop registration, March 2, 2013

Funding Support: none**International Collaboration:** No**International Travel:** No**Alejandro Lopez****Email:** arlopez@nmsu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 4

Contribution to the Project: Assisting Dr. Fernald and Dr. Ochoa with data research in Northern New Mexico. Assisted as a student helper with the RGSC 618 Interdisciplinary Modeling: Water-Related Issues and Changing Climate course held at NMSU, June 4th-15th, 2012.

Funding Support: NM EPSCoR**International Collaboration:** No**International Travel:** No**Sam Markwell****Email:** smarkwell@unm.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 2

Contribution to the Project: Graduate student in the Department of American Studies, UNM

Funding Support: NSF/RA**International Collaboration:** No**International Travel:** No**Elizabeth Samson****Email:** easamson@nmsu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1

Contribution to the Project: Graduate Student focusing thesis and GRA time on wildlife and ecosystems.

Funding Support: NM EPSCoR, Tri-State EPSCoR, EPSCoR**International Collaboration:** No**International Travel:** No

Sophia Thompson**Email:** sophiat4@unm.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 2**Contribution to the Project:** Graduate student in community and regional planning, UNM.**Funding Support:** NSF**International Collaboration:** No**International Travel:** No**Douglas Tolley****Email:** dtolley@nmt.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** NMT MS Student and RA collecting stream and spring samples and installing field equipment in Rio Hondo.**Funding Support:** EPSCoR**International Collaboration:** No**International Travel:** No**Lani Tsinnajinnie****Email:** ltsinnaj@nmt.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** NMT MS Student and RA conducting monthly field sampling in El Rito collecting snow, snowmelt, and installing field equipment.**Funding Support:** EPSCoR**International Collaboration:** No**International Travel:** No**Tristan Williams****Email:** tristanw@nmsu.edu**Most Senior Project Role:** Graduate Student (research assistant)**Nearest Person Month Worked:** 1**Contribution to the Project:** Responsible for data base entry and raw data collected in the field.**Funding Support:** none**International Collaboration:** No**International Travel:** No

Bobbie Jo Fossberg

Email: fossberg@nmsu.edu

Most Senior Project Role: Non-Student Research Assistant**Nearest Person Month Worked:** 6

Contribution to the Project: Program Coordinator-provides project support for CNH Acequia Team Members. Assisted with coordination of the Global Perspectives Symposium & Workshop, March 2-3, 2013.

Funding Support: Tri-State EPSCoR, NM EPSCoR**International Collaboration:** No**International Travel:** No**Kevin Boyko**

Email: kboyko@nmsu.edu

Most Senior Project Role: Undergraduate Student**Nearest Person Month Worked:** 6

Contribution to the Project: Intern student hired to assisted with with field and data research for Spring and Summer 2013.

Funding Support: NM EPSCoR**International Collaboration:** No**International Travel:** No**What other organizations have been involved as partners?**

Name	Type of Partner Organization	Location
Acequias of El Rito	Other Nonprofits	El Rito area of Northern New Mexico
Acequias of the Rio Hondo	Other Nonprofits	Rio Hondo area of Northern New Mexico
New Mexico EPSCoR	State or Local Government	Albuquerque, NM
New Mexico Institute of Mining and Technology	Academic Institution	Socorro, NM
Northern New Mexico Stockman's Association	Other Nonprofits	Taos, NM
Rio Hondo Valley Acequia Association	Other Nonprofits	Taos, NM
Sandia National Laboratories	State or Local Government	Albuquerque, NM
Taos Valley Acequia Association	Other Nonprofits	Taos, NM

Name	Type of Partner Organization	Location
Tri-State EPSCoR	State or Local Government	Western United States
UNM Center for Regional Studies	Academic Institution	Albuquerque, NM
UNM Community & Regional Planning Program	Academic Institution	Albuquerque, NM
UNM Maxwell Museum	Academic Institution	Albuquerque, NM
Alcalde Acequia Association	Other Nonprofits	Alcalde, NM
UNM Resource Center for Raza Planning	Academic Institution	Albuquerque, NM
US Geological Survey	Other Organizations (foreign or domestic)	United States
USDA Forest Service; Carson National Forest	State or Local Government	Carson, NM
USDI BLM Taos Field Office	State or Local Government	Taos, NM
Universidad de Concepcion	Academic Institution	Chile, South America
University of New Mexico	Academic Institution	Albuquerque, NM
Cultural Energy	Other Nonprofits	Santa Fe, NM
El Rito Acequia Association	Other Nonprofits	El Rito, NM
Environmental Protection Agency	State or Local Government	United States
La Nueve Acequias en el Rio Grande	Other Nonprofits	Northern New Mexico
Long Term Ecological Research Network	Other Organizations (foreign or domestic)	North America
NMSU Alcalde Science Center	Academic Institution	Alcalde, NM
New Mexico Acequia Association	Other Nonprofits	Santa Fe, NM

Full details of organizations that have been involved as partners:

Acequias of El Rito

Organization Type: Other Nonprofits
Organization Location: El Rito area of Northern New Mexico

Partner's Contribution to the Project:
Facilities
Collaborative Research

More Detail on Partner and Contribution: A. de la Otra Vanda, A. Madre, A. Alire. A, del Monte, A. del Jaral

Acequias of the Rio Hondo

Organization Type: Other Nonprofits
Organization Location: Rio Hondo area of Northern New Mexico

Partner's Contribution to the Project:
Facilities
Collaborative Research

More Detail on Partner and Contribution: La Cuchilla ditch, A. de Los Prando, A. de San Antonio, Canonictos ditch north, Canonictos ditch south, A. de Atalaya, A. Madre del Llano, A. de La Plaza

Alcalde Acequia Association

Organization Type: Other Nonprofits
Organization Location: Alcalde, NM

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution:

Cultural Energy

Organization Type: Other Nonprofits
Organization Location: Santa Fe, NM

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution: Robin Collier recorded audio of the Global Perspectives Symposium & Workshop, March 2-3, 2013. Placed recording on his website.

El Rito Acequia Association

Organization Type: Other Nonprofits
Organization Location: El Rito, NM

Partner's Contribution to the Project:
Collaborative Research

More Detail on Partner and Contribution:

Environmental Protection Agency**Organization Type:** State or Local Government**Organization Location:** United States**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

La Nueve Acequias en el Rio Grande**Organization Type:** Other Nonprofits**Organization Location:** Northern New Mexico**Partner's Contribution to the Project:**

Facilities

Collaborative Research

More Detail on Partner and Contribution: A. de Alcalde, A. de la Canova, A. Ancon, A. San Rafael del Guique, A. Madre del Bosque, A. de Los Chicos, A. Garcia, A. del Medio, A. Rinconada Isla

Long Term Ecological Research Network**Organization Type:** Other Organizations (foreign or domestic)**Organization Location:** North America**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

NMSU Alcalde Science Center**Organization Type:** Academic Institution**Organization Location:** Alcalde, NM**Partner's Contribution to the Project:**

In-Kind Support

Facilities

Collaborative Research

More Detail on Partner and Contribution:

New Mexico Acequia Association**Organization Type:** Other Nonprofits**Organization Location:** Santa Fe, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

New Mexico EPSCoR**Organization Type:** State or Local Government**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

New Mexico Institute of Mining and Technology**Organization Type:** Academic Institution**Organization Location:** Socorro, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

Northern New Mexico Stockman's Association**Organization Type:** Other Nonprofits**Organization Location:** Taos, NM**Partner's Contribution to the Project:**

Facilities

More Detail on Partner and Contribution: Allowed us to distribute surveys during their 2013 annual meeting.

Rio Hondo Valley Acequia Association**Organization Type:** Other Nonprofits**Organization Location:** Taos, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

Sandia National Laboratories**Organization Type:** State or Local Government**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

Taos Valley Acequia Association**Organization Type:** Other Nonprofits**Organization Location:** Taos, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

Tri-State EPSCoR**Organization Type:** State or Local Government**Organization Location:** Western United States**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

UNM Center for Regional Studies**Organization Type:** Academic Institution**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

UNM Community & Reginal Planning Program**Organization Type:** Academic Institution**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

UNM Maxwell Museum**Organization Type:** Academic Institution**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Facilities

Collaborative Research

More Detail on Partner and Contribution: UNM Maxwell Museum Staff to curate the Acequia Exhibit, utilizing materials, such as museum historical photographs.

UNM Resource Center for Raza Planning**Organization Type:** Academic Institution**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

US Geological Survey**Organization Type:** Other Organizations (foreign or domestic)**Organization Location:** United States**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

USDA Forest Service; Carson National Forest**Organization Type:** State or Local Government**Organization Location:** Carson, NM**Partner's Contribution to the Project:**

Facilities

Collaborative Research

More Detail on Partner and Contribution: Allowed access to grazing allotment livestock records.

USDI BLM Taos Field Office**Organization Type:** State or Local Government**Organization Location:** Taos, NM**Partner's Contribution to the Project:**

Facilities

More Detail on Partner and Contribution: Allowed access to grazing allotment livestock records.

Universidad de Concepcion**Organization Type:** Academic Institution**Organization Location:** Chile, South America**Partner's Contribution to the Project:**

Collaborative Research

Personnel Exchanges

More Detail on Partner and Contribution:

University of New Mexico**Organization Type:** Academic Institution**Organization Location:** Albuquerque, NM**Partner's Contribution to the Project:**

Collaborative Research

More Detail on Partner and Contribution:

What other collaborators or contacts have been involved?YES

Impacts**What is the impact on the development of the principal discipline(s) of the project?**

The discipline of community planning has been impacted by intensive use of visualization methodologies that can be applied to modeling of regional and inter-regional water plans.

Our component of the CNH Acequia project will promote a better understanding of the links that exist between grazed forest uplands and irrigated valleys.

What is the impact on other disciplines?

Other disciplines impacted are hydrology, ecology, and community economics in terms of utilizing a multidisciplinary framework for modeling natural and human system dynamics of resilience. This approach is potentially transformative to other world regions in high desert environments.

In addition, this study will provide insights on the interactions between two common pool resources (CPRs), surface irrigation water and grazing land. Both CPRs are critical to acequia communities yet have contrasting regulation and oversight. The first CPR, which is perhaps the most crucial, is almost entirely under *parciante* control, while the second is subject to fairly stringent government regulation and control. Livestock-raising appears to be the agricultural activity that links both these CPRs.

What is the impact on the development of human resources?

Steve Guldán conducted tours throughout the year of the Alcalde Science Center on acequia research to a variety of persons including those from New Mexico Acequia Association, Food Council members, attendees of the Global Perspectives Symposium & Workshop, and NMSU students.

A first-generation minority student will receive a graduate degree in the area of Rangeland management.

What is the impact on physical resources that form infrastructure?

Nothing to report.

What is the impact on institutional resources that form infrastructure?

Nothing to report.

What is the impact on information resources that form infrastructure?

Nothing to report.

What is the impact on technology transfer?

Nothing to report.

What is the impact on society beyond science and technology?

Beyond science and technology, the policy makers can also be impacted when results of the study are more widely disseminated.

This component will provide important contributions to modeling the resilience of acequia farming communities in northern NM.

Changes/Problems

Changes in approach and reason for change

Nothing to report.

Actual or Anticipated problems or delays and actions or plans to resolve them

Nothing to report.

Changes that have a significant impact on expenditures

Nothing to report.

Significant changes in use or care of human subjects

Nothing to report.

Significant changes in use or care of vertebrate animals

Nothing to report.

Significant changes in use or care of biohazards

Nothing to report.