

**11th ANNUAL
SCIENCE ON THE SONOITA SYMPOIUM
JUNE 22nd, 2019**



Annual Meeting of the Sonoita Valley Planning Partnership

Sponsored by:
Cienega Watershed Partnership

With Support from Partnering Organizations:
The Nature Conservancy
Bureau of Land Management
University of Arizona

At the
Sonoita County Fairgrounds
Sonoita, Arizona

The Science on the Sonoita Plain symposium was established to share results of scientific investigations that are occurring within the upper watersheds of Cienega Creek, Sonoita Creek, and the Babocomari River. The Symposium has been held annually to promote exchange among scientists, land managers, local landowners, interested citizens and students about the unique and diverse resources of the Sonoita Plain. Each year, the Symposium seeks to highlight timely themes that are important to the region's environment and that are of interest to researchers, land managers, and local communities.

These symposia grew out of the Sonoita Valley Planning Partnership (SVPP), a voluntary ad hoc association of agencies, user groups, conservation organizations, and individuals that since 1995 has been working to achieve community-oriented solutions to local and national issues affecting public lands within the Sonoita Valley. The Cienega Watershed Partnership, a 501c(3) non-profit organization, grew out of the SVPP to continue this important work throughout the Sonoita Plain. The CWP mission is to facilitate cooperative actions that steward the natural and cultural resources of the Sonoita Valley while enabling sustainable human use.

This year, our topical panel was organized by Pima County Natural Resources, Parks, and Recreation, with presentations covering climate, water, land management, restoration, and other themes – providing an overview of the County's long history of land conservation in the Cienega Valley, acquiring land in the 1980s for flood control, most significantly the Cienega Creek Natural Preserve. Following the adoption of the Sonoran Desert Conservation Plan in 2001, Pima County ramped up acquisition efforts in the valley to include lands used for ranches, recreation, and conservation. In addition to land management, Pima County had led monitoring efforts focused on water resources, wildlife populations, and wildlife habitat. The session included presentations on land acquisition, water monitoring, range management, conservation planning, and cultural resources, and was followed by an open panel discussion with presenters.

The afternoon session included a variety of updates and presentations from the Bureau of Land Management and CWP, from University of Arizona scientists, land managers and practitioners.

This proceedings offers abstracts and session descriptions covering all of the presentations and discussions throughout the day.

Edited by Larry Fisher & Tom Meixner (CWP & UA)
Proceedings compiled by Suzanne Wilcox (Audubon)

Planning Committee: Larry Fisher (Cienega Watershed Partnership and University of Arizona), Thomas Meixner (Cienega Watershed Partnership and University of Arizona), Shela McFarlin (Cienega Watershed Partnership), Gita Bodner (The Nature Conservancy), and Dave Murray (Bureau of Land Management)

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Larry Fisher (CWP)

AGENDA
SCIENCE ON THE SONOITA PLAIN
ELEVENTH ANNUAL SYMPOSIUM
June 22, 2019

- 8:00 Sign in and refreshments
- 8:30 Welcome and introduction: Tom Meixner, Cienega Watershed Partnership and University of Arizona
- 8:40 Panel Discussion – Pima County’s Role in Monitoring, Land Management, and Conservation (Karen Simms, moderator)
- 8:50 Cienega Creek Natural Preserve as a Conservation Catalyst – Julia Fonseca, Pima County Office of Conservation and Sustainability
 - 9:10 Pima County Regional Flood Control District’s (District) Floodprone Land Acquisition Program (FLAP) – Marisa Rice, CFM, Pima County Regional Flood Control District
 - 9:30 Water and Riparian Resource Trends in the Cienega Creek Natural Preserve: A review of 30 years of Data – Brian Powel, Pima County Natural Resources, Parks and Recreation, and Jeff Gicklhorn, Pima County Office of Sustainability and Conservation
 - 9:50 Walking the Stream as Protection: When Wet-Dry Mapping Can Help Protect Streams – Julia Fonseca, Pima County Office of Conservation and Sustainability
- 10:10 COFFEE BREAK
- 10:30 Pima County Rangeland Management Program: Present and Future – Vanessa Prileson, Pima County Natural Resources, Parks and Recreation
 - 10:50 Cultural Resource Management in the Cienega Creek Natural Preserve – Courtney Rose, Pima County Office of Sustainability and Conservation
- 11:00 Panel discussion, Q and A for Pima County panelists (Karen Simms, moderator)
- Interactive discussion with audience
- 12:00 Update on the Endangered Desert Pupfish (Doug Duncan)
- 12:10 LUNCH BREAK (bring your own)
- 1:00 Presentations (Gita Bodner, moderator)
- 1:00 – BLM Leadership update (Colleen Bergmanis)
 - 1:15 – State of the Cienega Watershed (Adriana Zuniga-Teran, Larry Fisher, Tom Meixner)

- 1:30 – Pima County update (Karen Simms)
- 1:45 – Evaluating Woody Plant Encroachment in Sonoran Grasslands for Brush Management Planning (Scott Jones, William A. Rutherford, Steven R. Archer)
- 2:15 – Site Prioritization, Selection, Assessment and Design for Erosion Control in the Ciénega Watershed (Trevor Hare)
- 2:30 – Improving Drought Monitoring on Rangelands by Making Better Use of Drought Indices (Trevor McKellar, Mike Crimmins, Marcel Schaap, Craig Rasmussen)

2:45 Symposium evaluation (Tahnee Robertson, CWP)

3:10 Closing remarks (Tom Meixner, CWP)

3:15 Adjourn

Poster

- Mapping Mesquite Communities at the Las Ciénegas National Conservation Area – Roy E. Petrakis, Laura M. Norman, Barry R. Middleton, Natalie R. Wilson, and Gita S. Bodner



KEY

CWP – Cienega Watershed Project
 WRRC – University of Arizona Water Resources Research Center
 US FWS – US Fish and Wildlife Service
 BLM – Bureau of Land Management
 CNF – Coronado National Forest

WELCOME

Tom Meixner (Cienega Watershed Partnership)

Thank you everyone for coming out and attending our 11th annual Science on the Sonoita Plain Symposium. I would like to point out that during the past year the Cienega Watershed Partnership has continued its work in the watershed, focusing on restoration, monitoring, youth engagement, and other important activities. Today, we have put together this special morning session that will feature Pima County's critical efforts and contributions with-in the watershed.

Biography (Meixner): is Professor and Associate Department Head, Hydrology and Atmospheric Sciences, University of Arizona. He also serves as Chair of the Board of Directors for the Cienega Watershed Partnership.

Pima County's Role in Monitoring Land Management, and Conservation

Presenter: Brian Powell (Pima County Natural Resources, Parks and Recreation)

Pima County has a long history of land conservation in the Cienega Valley, which is a significant contributing watershed for Tucson. The County began acquiring land in the 1980s for flood control, most significantly the Cienega Creek Natural Preserve. Following the adoption of the Sonoran Desert Conservation Plan in 2001, Pima County has ramped up acquisition efforts in the valley to include lands used for rancher, recreation, and conservation. In addition to land management, Pima County has led monitoring efforts focused on the water resources, wildlife populations, and wildlife habitat. These data have played an important role in current conversations of land use, including the proposed Rosemont Mine. This session provides an overview of the County's historical role in conservation and monitoring and highlight the ideas that go beyond the traditional constituencies.

Biography (Powell): Brian is currently an Assistance Division Manager within Pima County's Natural Resources, Parks and Recreation Department (NRPR). Before coming to NRPR in January 2019, he was a Program Manager with Pima County's Office of Sustainability and Conservation, where he oversaw the Pima County Ecological Monitoring Program (EMP), which tracks environmental conditions in the County's diverse land portfolio. Prior to coming to Pima County in 2007, Brian was a researcher at the University of Arizona where he directed a 10-park plant and animal inventory effort for the National Park Service. Brian received his MS in Wildlife Science from the University of Arizona (1999) and BA from the Evergreen State College (1995).

Cienega Creek Natural Preserve as a Conservation Catalyst

Presenter: Julia Fonseca, Pima County Office of Conservation and Sustainability

Abstract: In 1986, Pima County Board of Supervisors established the Cienega Creek Natural Preserve, in recognition of its role in providing natural flood storage and recharge for downstream urban areas, and as hoped-for mitigation under the Clean Water Act for bank protection work that was beginning downstream. While the U. S. Army Corps did not ultimately agree to accept the Preserve as mitigation land, the Preserve is today recognized as mitigation land under the Endangered Species Act for impacts to federal species covered under the Pima County Multi-species Conservation Plan.

Establishment of the Preserve launched a number of related conservation efforts, including:

- Acquisition and protection of the Empire-Cienega Ranch
- Elimination of a satellite city and its wellfield at Empirita Ranch
- Wet-dry mapping by Pima Association of Governments
- State standards for protection of water quality
- Land stewardship programs at Pima County Regional Flood Control District

Biography: Julia has worked on land and water issues in southern Arizona since 1986. She is Environmental Planning Manager for the Office of Sustainability and Conservation at Pima County, where she works with others to help implement the Sonoran Desert Conservation Plan. In 2008, she co-authored a report for EPA regarding the ecological and hydrological significance of ephemeral and intermittent streams. In a previous 22-year career with Pima County Flood Control District, Julia worked on water rights, land management, groundwater recharge and riparian habitat protection and restoration.

Pima County Regional Flood Control District's (District) Floodprone Land Acquisition Program (FLAP)

Presenter: Marisa Rice, CFM, Pima County Regional Flood Control District

Abstract: The District's Floodprone Land Acquisition Program (FLAP) was created in 1984, in response to the October, 1983 flood event. Initially, the program focused on purchasing properties damaged in the 1983 event and providing relocation assistance to flooded property owners. Later, the program was expanded to include the acquisition of undeveloped floodprone properties and upper watershed areas.

Purchasing flood and erosion prone land is a cost-effective strategy for minimizing flood damages. By acquiring floodprone land and thereby removing that land from development, the District can eliminate future losses on the acquired parcels. The District does not use eminent domain to force individuals to sell their property, rather the property owner must submit an application requesting the District purchase the property. Once an application is received, the District determines whether or not to purchase the property based on such factors as the severity of the flood hazards on the property, the property location in relation to other public lands, and available funding.

Besides minimizing flood damages to specific parcels, floodprone land acquisition yields a number of other important benefits. One immediate advantage is that purchasing undeveloped floodprone property eliminates the need for structural flood control improvements (such as bank stabilization, levees, etc.) that would otherwise be needed to protect these parcels. Another benefit is that the parcel's natural floodplain characteristics are preserved, which in turn helps reduce downstream flood peaks. Floodprone land acquisition also helps create recreational opportunities, maintain urban open space, preserve riparian habitat and enhance ground water quality.

In 2015, the District developed a Land Stewardship Program to address management of the growing acreage of open space lands acquired through FLAP. The goal of the program is "To inventory, monitor, protect, enhance and restore natural resources on District restored natural resource and open space lands...". Management actions include triennial inspections to inventory lands for natural and cultural resources, threats, and hazardous conditions, develop Land Management Plans by watershed, and identify opportunities for land stewardship and restoration.

Biography: Marisa moved to Tucson in 1995 to attend the University of Arizona and immediately fell in love with the Sonoran Desert, and after receiving a degree in Soil and Water Science has been practicing ecosystem restoration and land management in Southern Arizona for the past 18 years. Marisa has been with the District since 2005, and has led the Land Stewardship Program since its inception in 2015, overseeing implementation of stewardship projects throughout eastern Pima County. Prior to her current position, she implemented the District's Riparian protection regulations and managed ecosystem restoration projects, worked for a private consulting firm on groundwater recharge and mine reclamation projects, and a spent a brief period of time surveying soils in southern Colorado.

Water and Riparian Resource Trends in the Cienega Creek Natural Preserve: A review of 30 years of Data

Presenters: Brian Powel, Pima County Natural Resources, Parks and Recreation
Jeff Gicklhorn, Pima County Office of Sustainability and Conservation

Abstract: The Cienega Creek Natural Preserve is the “crown jewel” of the County’s extensive land holdings for natural resource conservation. The Preserve contains some of the region’s most important aquatic and riparian habitat and is home to a number of threatened and endangered species. Because of its regional importance, and in

consideration of the importance of water in maintaining and promoting the aquatic and riparian habitat, Pima County began monitoring water resources soon after the establishment of the Preserve in the 1980s. Data have been collected on a host of water and associated indicators: precipitation and drought severity, streamflow extent, discharge, depth to shallow groundwater, and extent and structure of riparian vegetation. In general, all water resources showed declines since monitoring efforts began. In most cases, these declines have been both statistically and ecologically significant. Extent of riparian forest overall has declined over time; however, those areas with remaining perennial water have continued to see riparian forest increase in size and cover. Understanding historical trends in water and associated resources helps provide data and context for future threats (e.g., Rosemont mine) and conservation opportunities (e.g., beaver reintroduction).



Biography (Powell): Brian is currently an Assistance Division Manager within Pima County’s Natural Resources, Parks and Recreation Department (NRPR). Before coming to NRPR in January 2019, he was a Program Manager with Pima County’s Office of Sustainability and Conservation, where he oversaw the Pima County Ecological Monitoring Program (EMP), which tracks environmental conditions in the County’s diverse land portfolio. Prior to coming to Pima County in 2007, Brian was a researcher at the University of Arizona where he directed a 10-park plant and animal inventory effort for the National Park Service. Brian received his MS in Wildlife Science from the University of Arizona (1999) and BA from the Evergreen State College (1995).

Biography (Gicklhorn): Jeff is currently a Program Coordinator with Pima County’s Office of Sustainability and Conservation (OSC) working to implement the Ecological Monitoring Program for the County’s Multi-Species Conservation Plan. He has broad prior experience implementing ecological monitoring with both federal and state agencies in both land management and research context. Jeff received his MS in Natural Resources from the University of Nevada, Reno in 2017 and BA from the University of California, San Diego in 2010.

Walking the Stream as Protection: When Wet-Dry Mapping Can Help Protect Streams

Presenter: Julia Fonseca, Pima County Office of Conservation and Sustainability

Abstract: State and federal agencies are increasingly relying on fine distinctions in flow regime for regulating activities under the Clean Water Act and other laws. Persistence of streamflow does not fit into the regulatory frameworks imposed upon it. Water availability in streams is highly variable in our region both in time and in space. Definitions given to the terms “perennial”, “intermittent” and “ephemeral” also vary, and seldom address either the spatial variability of “interrupted” streams or the anthropogenic factors that cause variability, or the presence or absence of saturated conditions below the streambed. In this context, mapping the distribution of persistent flow (wet-dry mapping) can either enhance or reduce protection for water quality and future water availability along streams in Arizona. This presentation will discuss real-life examples drawn from the Cienega watershed, and elsewhere.

Biography: Julia has worked on land and water issues in southern Arizona since 1986. She is Environmental Planning Manager for the Office of Sustainability and Conservation at Pima County, where she works with others to help implement the Sonoran Desert Conservation Plan. In 2008, she co-authored a report for EPA regarding the ecological and hydrological significance of ephemeral and intermittent streams. In a previous 22-year career with Pima County Flood Control District, Julia worked on water rights, land management, groundwater recharge and riparian habitat protection and restoration.

Pima County Rangeland Management Program: Present and Future

Presenter: Vanessa Prileson, Pima County Natural Resources, Parks and Recreation

Abstract: In response to these issues and the desire to preserve ranch heritage, Pima County acquired 14 ranches, including associated state and federal livestock grazing leases, with voter-supported bonds in 2004 and 2007. Most of the ranches have active livestock operations and are managed through formal agreements between Pima County and private sector ranchers. Pima County Rangeland and Natural Resource managers work collaboratively with the ranchers, agency representatives, partner organizations and other stakeholder groups to monitor and manage these working landscapes.



The Pima County ranches need to continue operating to achieve the desired outcomes of the Sonoran Desert Conservation Plan (SDCP) that include working ranch conservation, open space and biological conservation, and economic development. It is also necessary to keep these ranches operating in order to ensure maintenance of existing infrastructure, which includes hundreds of wells and water developments, miles of ranch roads and fences, and over 150 ranch buildings and associated infrastructure.

Long term goals for the Pima County ranches are to 1) manage livestock grazing to meet Pima County Range Management Standards and Guidelines, SDCP and Multi-species Conservation Plan (MSCP) standards through science-based, collaborative rangeland monitoring; 2) implement watershed scale resource management planning with a collaborative approach by including all relevant land agencies, non-profit organizations and private sector ranchers in the process and 3) build programs to provide leased land and ranch education opportunities to new generations.

Biography: Vanessa is the Range Program Manager for Pima County Natural Resources, Parks and Recreation Department. She has been helping implement the Ranch Conservation element of the Sonoran Desert Conservation Plan since May 2016. She has worked on cattle ranches in the southwestern U.S., and for the U.S. Forest Service on the Tonto National Forest in Payson, AZ in Rangeland Management. Vanessa earned a Master of Science degree at New Mexico State University in Range Science with her research focusing on cattle grazing patterns in woodland-grassland environments and assisting with a similar research project in Argentina. Previously, Vanessa received a degree in Environmental Economics, Policy and Management from Oregon State University. She grew up in Tucson and did not anticipate a return after the above adventures until she had the opportunity to join the Pima County Range Program.

Cultural Resource Management in the Cienega Creek Natural Preserve

Presenter: Courtney Rose, Ph.D., Pima County Office of Sustainability and Conservation

Abstract: Since the 1950s, many archaeological projects have been carried out in the Cienega Creek Natural Preserve (CCNP), resulting in the identification of nearly 100 archaeological sites. Since 2003, Site Stewards (volunteer members certified by Arizona State Parks) have been conducting weekly field checks of 91 archaeological sites within the CCNP, resulting in substantial information on site conditions. Even with the large number of archaeological sites already recorded and currently being monitored, there are still some gaps in our data that need to be addressed in order to successfully manage and monitor the cultural resources in the CCNP. For instance, many of the archaeology research projects over the years were not systematic inventories and some of the cultural resources data collected from individual compliance and research projects is outdated. Site Stewards have also noted that there are many archaeological sites with incomplete or inaccurate site boundaries as well as additional archaeological sites noted along their monitoring routes that have never been officially recorded. Given the high density of sensitive archaeological sites and the potential to protect these sites over the long term, a large endeavor to compile all known cultural resources information from the CCNP was accomplished last year in preparation for a focused inventory in the near future. The proposed inventory, in combination with strengthening the site steward program, will increase our ability to monitor and protect archaeological sites. This presentation will discuss the nature of the information that is already known, our current monitoring program, and the efforts underway to refine our cultural resources management goals in the CCNP.

Biography: Employed by Pima County since 2008, her role includes managing the cultural resources compliance process for County-sponsored projects, developing program goals for planning reports, overseeing site stewards, and management of cultural resources on County conservation lands. Prior to working for Pima County, Dr. Rose worked in contract archaeology, instructed archaeological field schools for Old Pueblo Archaeology Center, and taught courses in anthropology, statistics, and archaeology at Pima Community College and the University of Pittsburgh. Her doctoral research focused on archaeological investigations in the Andean region of South America.

Pima County Panel Discussion

Karen Simms, Natural Resources Division Manager, Pima County Natural Resources, Parks and Recreation – Introduction to panel.

Pima County is conducting extensive environmental planning under the Multi-Species Conservation Plan (MSCP), the plan that was required to get the Section 10 permit. We have two years to develop a plan. Through the process of developing the MSCP's required plans, we will need to identify resource priorities, which will include a plan for the Cienega Corridor. In 2003 we had the Missing Link, so now we have come full circle.

KEY: CR- Courtney Rose, JF- Julia Fonseca, JG- Jeff Gicklhorn, KS- Karen Simms, VP- Vanessa Prileson, MR- Marisa Rice and BP- Brian Powell

Panel discussion:

Q: How does the cultural resources office interact with the ranch program when it comes to range management and historical improvements, water distribution systems and fences that need to be maintained or replaced?

CR: We do work closely. A few weeks ago, for example, we reported on a historic building that was falling down. Vanessa sends me her lists of rancher needs regarding facilities that might have issues (e.g., cattle guards, drinkers, etc.). If they are located on county conservation land, she has an AZ Antiquities Act permit to do the archeological survey. If there isn't any perceived impact, then it's not a problem and we don't need to do additional archeological surveys and mitigation. Even if something would be needed, we can work together to find a way to avoid the cultural resources constraints. We work on this on a case by case basis.

Q: A big picture question: it is truly special to have both ends of the watershed represented today. What do all of you see as the conservation strategies that look the most different if we're seeing and acting on the watershed as a whole versus one end or the other?

JF: Karen gave one good example, i.e., that grant funds are often federal and need to go through NEPA, so collaborating on watershed-level restoration planning is a great idea.

JG: The upper and lower parts of the watershed are inherently different and the county has different mandates, so it's important to identify different conservation priorities.

Q: What's your response to introducing beavers into the watershed?

KS: Beaver re-introduction could be an excellent conservation and land management tool. We have much less water than 10 years ago when we first proposed reintroducing beaver. We have heard that on the San Pedro beaver populations are now declining. We could try to achieve more infiltration of the water and better manage the riparian areas on the creek. From the County perspective, there are concerns about potential impacts on vegetation, so we will need to monitor well. But if beavers result in increased water on the land, then there would obviously be significant benefit.

JF: My concern about beaver would be on potential impacts with invasive species. They probably wouldn't persist but it could help with infiltration. In any case, I'm interested in re-introduction as an experiment to learn from.

Q: Vanessa, when you talk about RFP for lessons from grazing, I assume that that would include Pima County goals about how livestock could improve the resource.

VP: Yes, we would use grazing as a tool, to see where this is working or isn't, here are the conservation and grazing requirements, etc. In Boulder County, CO they have a rigorous farm leasing program that we're looking at. There are grazing fees involved, but in general we would be asking for a management plan and choosing what best meets our requirements.

Q: Do you ever limit sharing your site locations with the public?

CR: Yes, it's against the law to publish cultural site data. This is why I've asked that my presentation not be recorded or shared in any way, since we are responsible for protecting confidentiality of this information.

Comment from the audience: As a point of order, the AZ voters actually approved an amendment to allow the State Lands Department to do land exchanges, but this was tied to consideration for security issues related to our military bases. As sideboards – we must conduct public hearings, conduct appraisals, and there is an expensive application process to the Lands Department that has to be approved by the Legislature. So the authority does exist, but it's up to the State Lands Department and the Land Commissioner to make it happen.

Q: How much does Pima County spend on conservation each year?

KS: That's a hard question to answer because of the way our budgets come in; there's a lot mixed in there. Our NR division budget is \$2.5 M but goes to environmental education and other efforts that aren't specifically conservation, but do benefit conservation.

JG: We spend just over \$1 M per year on the administration of the MSCP.

JF: The budget includes some other provisions that precede MSCP and the acquisition of those lands.

MR: Flood Control spends approximately \$250K for land stewardship and related activities. For flood plain management, for example, we spent \$66K for one acquisition.

BP: As you know, Pima County voters approved a bond in 2005, which gave us permission to spend \$177M to purchase open space lands.

VP: For the Range department, I have two staff who live and work on our ranches; maintaining those two ranch headquarters is about \$250K, which is a large percentage of the range budget.

Q: Follow up for Vanessa, is retiring any county ranches an option or leasing for a different use like jackrabbits?

VP: The goal is to develop working ranches and what is approved for the grazing leases.

BP: When we talk about large landscape conservation, the inclusion of the ranch element in the MSCP isn't just lip services, it was the recognition that the largest areas of undeveloped open space are owned by ranchers. The challenge is to balance natural resource conservation and ranch impacts. We have ranch standards and guidelines to help achieve this balance.

Q: Looking at cultural resources on the preserve, and the impacts of erosion to those sites, what's the nature of your collaboration/cooperation with the tribes?

CR: Just started collaborating with the TO and Hopi, asking for input on these types of questions. This might not be the case for every tribe. Erosion may be a natural process; more damage might be done to cultural materials, so we need to actively try to prevent it from occurring.

Q: There seems to be a lot of data in the Cienega Creek Watershed except Mescal Wash. Is there a push to gather more data there?

KS: Yes, that's a pretty big drainage and brings in runoff from the flanks of the Mescal mountains, so we are definitely looking at that area.

Q: What kind of adaptive management strategy is needed for Cienega Creek?

KS: The big risks from climate change will be more, and more severe precipitation, with more erosion, and more sediment. Will the channel start filling up? Will there be stream power to damage built environment? These are some of the issues we will be facing.

Q: What about use of upstream check dams?

KS: Yes, we could use rock structures to create a more resilient upland vegetation community, but unfortunately we don't own much of that land so we would need to look at opportunities to partner with landowners.

VP: Some of the ranches show up to 50% die-off of native grass populations – that's in rested pastures. If we have continued dry winters the native grasses don't have the chance to last until spring rains or the arrival of the monsoon in the summer. In addition to upland erosion control, will see more exotic grasses moving in that can tolerate drier climates.

JF: We have a big program to suppress invasive grasses but they are also holding the soil.

BP: The Cienega Creek Preserve is the "tail pipe" of the watershed, so our ability to affect change is constrained. Also, this is an important story to engage the community on. How do these changes relate to groundwater replenishment? The value of these stories is one of the reasons we're investing resources there. I also want to say that we see an important role in public engagement and inviting people to experience these places. There are other places where mitigation lands are locked up, but we want these to be more open to the community. We realize that taxpayers paid for these lands and they should get to learn and experience the places they paid for. We want them to be more involved in places, to understand and know them.

KS: In terms of adaptive management, there are a lot of opportunities to engage with other entities in the watershed. We set up the Las Cienegas National Conservation Area (LCNCA) plan to implement adaptive management. And for Pima County, by being part of the upland restoration environmental assessment, has opportunities to implement strategies on the larger landscape to be better prepared for drier conditions. There may be ranches in the longer term that won't be able to sustain grazing, so we want to build in the flexibility and learning from adaptive management.

Q: In all of the presentations, each of you talked about partnerships and the importance of working with other agencies and organizations, and with the public. I'd like each panelist to talk about an opportunity you see in your program to involve the public or partners.

MR: The range program is often overwhelming for me, so it's fortunate that we have partners like the Altar Valley Conservation Alliance (AVCA), and the Cienega Watershed Partnership (CWP). There are a lot of complicated challenges. Every couple of weeks something happens...

CR: A program like site stewardship would be an important opportunity. I am currently the sole person doing the inspections. Would be nice to have a program where the public could take ownership to inspect an area annually or biannually.

JF: We should encourage citizens to get involved in higher level processes going on, like rulemaking on water quality.

JG: For the ecological monitoring program, we work with many different constituencies. There are lots of great stories, so the challenge for us is how to take the raw data we collect, and turn it into accessible stories that the public can relate to.

BP: We can support important youth stewardship programs like CWP's YES! Program at the LCNCA. But we'd also like to see this program expand to include our county lands.

KS: Everything we are doing here with CWP is based on partnerships and collaboration, and this has been the case since the very beginning, with the establishment of LCNCA. We should all be very proud of ourselves with what we have accomplished in terms of building solid and enduring partnerships, and in seeing the expanded impact this is having.

BLM Update

Presenter: Colleen Bergmanis

By way of introduction, I'm the new Assistant Field Manager for the Tucson Field Office. My background includes a Bachelors in Geology/geophysics, and a Masters degree in natural resources and environment. I spent 9 years in Germany for the Department of Defense, managing their training lands; then worked in Colorado Springs with the US Forest Service. Unfortunately, Margie Guzman is on a fire, and Jayme Lopez is on wilderness training, so neither of them are here today.

In terms of BLM program updates, here is what I can share:

- BLM has just completed three new staff hires of technicians.
- The office has been realigned, so that instead of managers for each conservation area, Margie and I are in charge of all land management responsibilities – Margie is responsible for renewables; and I'm responsible for non-renewables, which include cultural heritage, recreation, and realty.
- We'll be conducting wet-dry mapping for the San Pedro and Las Cienegas NCAs.
- We've recently has some small fires, mostly in the Lower San Pedro river area (most of these have been less than an acre, although the Silver Fire was 220 acres).
- NEPA for the LCNCA landscape restoration Environmental Assessment will be heading to the contractor later this month. Keystone burn EA is in its final stages.
- For vegetation management projects in 2020 – mesquite thins, salt cedar SPRNCA, the total targeted acres in 2020 is 5,500 acres.
- National Public Lands Day is coming up soon – we'll have announcements sent out about this shortly.
- We will be removing some of the Chiricahua Leopard Frog infrastructure.

Q: Are there plans to turn the frog pond into an interpretive pond?

A: I think it's all getting cleaned up, though this is not off the table.

Q: What's the plan for addressing issues related to the new ranch house?

A: The Empire Ranch Foundation will be funding the rehabilitation/abatement of the house by the end of this calendar year.

Biography: Colleen Bergmanis joined the BLM Tucson Field Office as Assistant Field Manager for non-renewable resources in November 2018. She has an MS in Natural Resource and Environmental Management (2003), and a BS in Geology and Geophysics (1999) from the University of Hawaii, Manoa. She worked for the US Army in Europe, and for the USDA Forest Service, before joining the BLM.

State of the Cienega Watershed

Presenters: Adriana Zuniga-Teran, Larry Fisher, and Tom Meixner

Abstract: Over the past four years, the Cienega Watershed Partnership (CWP) has worked with partners to identify core indicators that provide an annual snapshot of watershed health in the Cienega Watershed. The State of the Watershed assessment allows CWP to capitalize on existing data and provides a mechanism for regular evaluation of watershed health, to inform ongoing adaptation of program priorities and actions. The assessment now includes data covering 20 indicators, encompassing issues related to climate, water, ecology, and socio-economic conditions. In this presentation, we will share the results of the third annual assessment of the state of the watershed, including an analysis of key trends and recommendations of management actions that emerged during a recent State of the Watershed workshop.

Biography (Zuniga-Teran): is an Assistant Research Scientist at the University of Arizona's Udall Center for Studies in Public Policy and the School of Landscape Architecture and Planning. Adriana works with stakeholders and community partners to answer questions related to water security, urban resilience, and environmental justice, by focusing on greenspace/green infrastructure across the urban-rural continuum.

Biography (Fisher): is Research Professor in the School of Natural Resources and the Environment, University of Arizona. He is also a member of the Board of Directors of the Cienega Watershed Partnership.

Biography (Meixner): is Professor and Associate Department Head, Hydrology and Atmospheric Sciences, University of Arizona. He also serves as Chair of the Board of Directors for the Cienega Watershed Partnership.

Evaluating Woody Plant Encroachment in Sonoran Grasslands and Brush Management Planning

Presenters: Scott Jones, and William A. Rutherford

Abstract: Rangelands are characterized by mixtures of herbaceous and woody plants that sustain populations of various wildlife and livestock. Over the past century, rangelands have experienced land cover shifts with native and exotic shrubs displacing grasses and forbs. Increases in the type and abundance of woody plants, collectively termed woody plant encroachment (WPE), can thwart land management goals and objectives. Brush management via mechanical, herbicidal, cultural, and/or burning treatments is often used to reduce woody plant cover and induce the growth of herbaceous species. Brush management can be costly and the treatments short-lived, with shrubs often returning within 5-15 years post-treatment. This talk will provide historical insights into WPE in southern Arizona as well as present a modeling effort for determining a site's risk to undergo further encroachment.

Scott will first present on the long-term rates and patterns of WPE by velvet mesquite (*Prosopis velutina*) across the Las Cienegas National Conservation Area (LCNCA). These results have been ascertained through remote sensing methods using a data set consisting of both historical time-series aerial photography and modern satellite imagery spanning from 1936-2017. He will explore how topographic variables have dictated both the rate and dynamics of WPE across the landscape. Findings presented will provide a historical context to the WPE phenomenon in southern Arizona and identify areas on the LCNCA that have undergone heavy encroachment contrasted with areas of little change.

Austin will next present a preliminary spatial modeling effort for determining the extent to which sites may be at their maximum potential woody cover for assessment of WPE risk (e.g., sites below their woody cover potential = higher risk for future additional cover). The initial model will be developed at the Santa Rita Experimental Range (SRER), where the heterogeneous landscape of the SRER (e.g., contrasting soil and vegetation types across elevational and climatic gradients) and its well-documented history of WPE provides an ideal testing location for predicting landscape-scale risks to WPE. This model will allow for a spatially explicit evaluation of WPE and risk within individual pastures/allotments to help land managers prioritize when and where to implement brush management treatments.

Biography: Scott Jones is a Ph.D. candidate at the University of Arizona. His research is taking a holistic approach to the shrub encroachment phenomenon by exploring the long-term rates and dynamics of encroachment, how this shift has altered the delivery of ecosystem services as well as quantifying stakeholder demands for these rangeland services. His research will help better align when, where, and under what circumstances brush management could be undertaken to achieve conservation goals desired most by stakeholders.

Biography: Austin Rutherford is a Ph.D. student at the University of Arizona. His current research centers around the mechanisms and proactive management of shrub encroachment. Austin utilizes field-based experiments to investigate the critical seedling establishment phase of velvet mesquite shrubs in Sonoran Desert grasslands. These results assist him in the development of an interactive online tool that will allow land managers in southern Arizona to evaluate their land's susceptibility to shrub encroachment.

Site Prioritization, Selection, Assessment and Design for Erosion Control in the Ciénega Watershed

Presenter: Trevor Hare, Watershed Management Group

Abstract: In 2016 Watershed Management Group (WMG) was contracted by the Ciénega Watershed Partnership (CWP) to develop an erosion control/riparian restoration prioritization process for the Ciénega Creek Watershed. Through that process 12 sites were identified as high priorities through an expert opinion exercise and those sites fell within polygons identified as having high potential for erosion based on slope, soil erodability and proximity to linear infrastructure (roads and pipelines). The erosion control/riparian restoration prioritization process and the identified high-priority sites were then used to develop two successful grant proposals to address erosion issues at a subset of these sites. In 2017 CWP with WMG as a contractor was awarded approximately \$185,000 through the Bureau of Reclamation's WaterSMART program (Sustain and Manage America's Resources for Tomorrow) and in 2018 WMG was awarded approximately \$170,000 through the Arizona Department of Environmental Quality's Watershed Preservation Grant program.

In late 2018 and early 2019 site assessments were carried out by WMG in cooperation with CWP, BLM, and personnel from three Pima County departments –Regional Flood Control District, Natural Resources, and Sustainability and Conservation. Sites are located on both BLM and Pima County lands, and are in tributaries to Ciénega Creek. In November of 2018 a Site Assessment and Designs report was submitted to BOR for five sites –49 Wash (BLM), Davidson Canyon Stock Tank (PC), Horseshoe Bosque (PC) and two sites downstream of Pantano Dam (PC). In May 2019 a Site Assessment and Designs report was submitted to ADEQ for four sites –Empire Gulch (BLM), Gardner Canyon Sacaton Flat (BLM), Old Pantano South Road (PC), and another site downstream of Pantano Dam (PC).

Site designs call for the installation of erosion control structures such as Zuni bowls (head-cut arrester), media lunas (flow spreaders) and one-rock dams (flow slowing and grade control), and we will be using different combinations of workforces, including WMG's crew, American Conservation Experience and Arizona Conservation Corps crews, and local landscaping companies, to install the structures.

Next steps include NEPA compliance work being done by the BLM under their Las Ciénegas National Conservation Area Brush Treatment and Erosion Control Environmental Assessment, which includes cultural clearances on BLM lands. Cultural clearances on Pima County lands will be conducted by contractors for the Office of Sustainability and Conservation.

Biography: Trevor Hare graduated from the University of Arizona in 1991 with a degree in Ecology. For ten years he studied the impacts of suburban development on rattlesnakes and Gila monsters. Trevor has practiced riparian and upland restoration across the Sky Island Region for the past 25 years and developed a robust methodology for the assessment, planning and design of restoration projects, which has resulted in over \$2,500,000 of on the ground restoration work in SE Arizona, SE New Mexico and northern Sonora.

Improving Drought Monitoring on Rangelands by Making Better Use of Drought Indices

Presenters: Trevor McKellar, Mike Crimmins, Marcel Schaap, Craig Rasmussen
Department of Soil, Water and Environmental Science, University of Arizona

Abstract: Arizona's grasslands are an important ecosystem used for livestock forage, habitat conservation, and open space that are sustained primarily on rainfed agriculture. Arizona's unique seasonal transitional climate provides precipitation to these lands mainly during the winter rainy season and summer monsoon. Monitoring drought associated with delays in the timing, magnitude and frequency of precipitation events can benefit rangeland managers and decision makers when anticipating and responding to drought conditions. Numerous drought indices based on climate anomalies, ecological data and satellite products are readily available to help land managers and decision makers track drought conditions. These indices represent different aspects of hydroclimatic variability within soils and thus objectively identifying the index that best represents drought impacts on grassland ecosystems and informs range management activities remains a significant gap for applying available climate information to land management actions. To address this gap, we use modeled soil moisture data as an objective measure against which to evaluate different drought indices. Climate, soils and vegetation information from Las Cienegas National Conservation Area in Southern Arizona were used to model daily soil moisture and produce a new Modeled Soil Moisture Index (MSMI). Comparing the MSMI with different standardized drought indices, like the Standardized Precipitation Index (SPI), gives a relationship between the memory inherently built into soils and the memory associated with index time windows – where longer time windows represent deeper soil depths. This relationship varies based on soil and vegetation, allowing rangeland managers who know this information to make better informed drought management decisions about their land. Results from this project are summarized into an online web application where users can learn more about which drought index best represents their land and how past drought events are represented by the MSMI and different drought indices. This application will allow for increased drought monitoring planning and decision making while removing the demand on users of needing to make complex interpretations between indices. Given the importance of these ecosystems, understanding how drought indices represent Arizona's grasslands is important for future drought monitoring and planning.

Biography: Trevor McKellar is a PhD student in the Department of Soil, Water and Environmental Science at The University of Arizona. He received a B.S. in Geosciences, and an M.S. in Soil, Water and Environmental Science, also from the UofA. For the past few years, he has been working with Mike Crimmins, Extension Specialist at UofA, to improve the use of drought indices on rangelands by incorporating soil moisture modeling. Additionally, as part of a grant awarded by NASA, he is developing an online web application which summarizes results from this project and allows the public to learn more about how different drought indices represent their land.

POSTER

Mapping Mesquite Communities as the Las Cienegas National Conservation Area in Arizona, USA

Roy E. Petrakis¹, Laura M. Norman¹, Barry R. Middleton¹, Natalie R. Wilson¹, Gita S. Bodner²

¹ Western Geographic Science Center, U.S. Geological Survey, Tucson, AZ

² The Nature Conservancy, Tucson, AZ

Abstract: Velvet mesquite (*Prosopis velutina* – hereafter referred to as mesquite) is native to the semi-arid deserts and grasslands of the southwestern United States and northwestern Mexico. Because mesquite is highly valued in riparian “bosque” communities, while being a target for removal where it has expanded into adjacent grasslands, managing mesquite poses a unique management challenge for both private and public land owners. In the riparian Las Ciénegas National Conservation Area (LCNCA) managed by the Bureau of Land Management, several other projects have mapped the location and composition of various mesquite communities within the LCNCA and surrounding uplands, but have been limited in location, scale and accuracy. The objectives of this pilot study were to produce a map of mesquite bosque and related riparian vegetation communities present within the LCNCA and develop a semi-automated cloud-computing-based classification approach for broader-scale mapping efforts. First, we delineated a land cover classification by hand using aerial imagery for the near-stream areas of the northern reaches of the LCNCA. We then developed training data for a semi-automated land cover classification within the image processing platform Google Earth Engine (GEE), by quantifying mesquite community spectral, temporal, and structural traits. Our initial mapping process showed that mesquite communities cover approximately 78% percent of our study site, and are more common as distance from perennial water sources increases. Spectral, temporal, and structural traits differ between the mesquite communities and associated riparian vegetation types, which permits automated differentiation of these vegetation communities using GEE. Traits also differ across mesquite community types, which helps distinguish riparian bosques from dryer shrub communities. Our mapping also recognized some intermediate woodland and grassland communities. Potential expansion of this project would include on-the-ground validation of the map we produced, expansion to the surrounding upland areas, and mapping other riparian sites in the region including the southern parts of the LCNCA.

Biography: In 2015, Roy received a MA in Geography from the University of Arizona. His thesis was centered on understanding the implications of historic management practices and fluctuating climate on riparian vegetation along the Rio Grande in central New Mexico. With the USGS, Roy has worked on several projects focusing on use of remote sensing and GIS sciences to better understand issues regarding land use/land cover change, climate, management, and ecology within areas of the arid southwestern US. Various projects include assessing forest dynamics on the San Carlos Apache Reservation, global flood mapping, and mapping soil disturbance and yellow-billed cuckoo habitat in Arizona.

