

**Appleton-Whittell Research Ranch
of the
National Audubon Society, Inc.
2016 Annual Report**

Every experiment needs a control, but for decades a great experiment – ranching - was underway in the Southwestern USA without benefit of a control. Unlike the Great Plains, which co-evolved with bison, the prairies throughout most of the Southwest co-evolved without herds of large herbivores. Changes in hydrology, soils, plant communities, and animal populations followed the introduction of domestic livestock. Yet, without a control or reference area there was no way to tease out whether those changes were due to ranching or whether those changes were the result of natural events.

In 1968 Frank and Ariel Appleton, owners of the Elgin Hereford Cattle Ranch, recognized the issue and decided to take steps to rectify the problem. They sold their cattle and created the Research Ranch to be a control or reference area to compare in the experiment of livestock grazing. Scientists began studying changes over time within the Research Ranch. In addition, thanks to enlightened ranching neighbors, scientists were encouraged to conduct cross-fence comparisons. Every year the science program grows – climate change has become a topic, as has the impacts of invasive species, fire ecology, exurbanization, even viticulture. In 2016, there were 47 on-the-ground research and monitoring projects representing twenty academic institutions, nine governmental entities, and ten NGOs, L3Cs, LLCs or individuals. Hundreds of publications have resulted from work on AWRR, and thousands of acres of rangeland in the Southwest are in better condition due to the science that is possible thanks to the Research Ranch.



Now known as the Appleton-Whittell Research Ranch, the 8000-acre ecological field station has become a sanctuary for native biota. More than 500 native plant species have been documented within the boundary of AWRR, along with over 260 avian species, 50 reptile and amphibian species, and nearly 50 mammalian species. In addition, AWRR is an example of collaborative conservation: Audubon holds title to a portion of the facility (donated by the Appletons), and manages the remainder of the property under contractual agreements with the US Forest Service, the Bureau of Land Management, The Nature Conservancy, Resolution Copper Mining Company, and The Research Ranch Foundation. AWRR’s “Living Gently on the Land” education programs empowers residents to appreciate and protect the environment of which they are a vital part.

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Linda Kennedy, Ph.D. Director
 Roger Cogan, Conservation Program Manager
 Suzanne Wilcox, Office Manager

GENERAL CONDITIONS ON AWRR

The total precipitation at headquarters reached 18.5” for the calendar year, which included 7.36” recorded in August, the greatest total for that month since at least 2000. The proportion of cool season to warm season precipitation is holding steady at 30% to 70%. Although the annual precipitation was above average, no events triggered significant stream flow; none of the three major drainages – Post, O’Donnell, Turkey - carried water to the confluence east of Headquarters. The depth-to-groundwater readings at wells and piezometers across the Research Ranch fluctuate seasonally, but none show downward trends.

Precipitation at Headquarters, in Inches

Precipitation at Research Ranch Headquarters (inches)															Cool Season	Warm Season
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Oct-Mar	Apr-Sep	
2000	0.01	0.28	0.41	0.02	0.00	3.60	1.45	3.80	1.05	10.50	0.60	0.00	21.72		9.92	
2001	1.40	1.80	0.00	1.81	0.00	1.11	3.50	3.10	2.53	0.00	0.09	0.22	15.56	14.30	12.05	
2002	0.45	0.00	0.02	0.00	0.00	0.00	3.03	0.40	2.77	0.58	0.38	0.98	8.61	0.78	6.20	
2003	0.00	2.02	0.20	0.00	0.00	0.00	3.49	4.58	1.50	1.75	0.95	0.32	14.81	4.16	9.57	
2004	1.58	1.01	0.63	1.03	0.00	0.22	2.26	1.81	0.71	0.17	0.58	1.13	11.13	6.24	6.03	
2005	2.08	1.21	0.25	0.24	0.87	0.09	2.02	4.51	2.07	0.61	0.00	0.09	14.04	5.42	9.80	
2006	0.03	0.00	1.01	0.00	0.00	1.79	6.96	5.81	2.98	0.09	0.00	0.44	19.11	1.74	17.54	
2007	1.29	0.00	0.80	0.27	0.00	0.17	7.05	2.27	1.73	0.59	0.74	2.16	17.07	2.62	11.49	
2008	0.65	0.72	0.05	0.00	0.35	1.78	4.82	3.77	0.91	0.53	0.85	0.12	14.55	4.91	11.63	
2009	0.35	0.35	0.26	0.13	0.32	0.62	3.01	2.40	2.01	0.64	0.26	0.62	10.97	2.46	8.49	
2010	4.57	2.05	0.62	0.57	0.00	0.04	6.05	5.83	0.75	0.17	0.04	0.73	21.42	8.76	13.24	
2011	0.00	0.26	0.03	0.12	0.00	0.00	4.44	2.53	2.23	0.23	0.69	2.42	12.95	1.23	9.32	
2012	0.16	0.26	0.42	0.00	0.50	0.13	10.78	1.87	1.18	0.00	0.20	1.97	17.47	4.18	14.46	
2013	1.01	0.44	0.23	0.04	0.00	0.36	3.92	3.03	3.07	0.00	1.38	0.77	14.25	3.85	10.42	
2014	0.00	0.12	2.02	0.11	0.00	0.00	3.24	5.49	7.17	1.07	0.00	0.71	19.93	4.29	16.01	
2015	2.85	0.08	1.29	0.71	0.38	0.43	2.41	3.07	3.12	1.51	1.05	0.66	17.56	6	10.12	
2016	1.71	0.62	0.12	0.40	0.06	1.50	1.93	7.36	2.43	0.23	0.16	1.98	18.50	5.67	13.68	
Mean	1.07	0.66	0.49	0.32	0.15	0.70	4.14	3.63	2.25	1.10	0.47	0.83	15.79	5.44	11.17	

Along with the absence of flooding events, we found no evidence of fires, only one cow, and cross-border traffic, while still present, is quite low.

COORDINATED RESOURCE MANAGEMENT PLAN



The CRMP for the Research Ranch is out for signature! This effort, by Kristen Egen, USDA-NRCS District Conservationist, with a talented team from NRCS and support from partners, is the result of two years of planning, field work, archival organization, and mapping. The CRMP is available on the Research Ranch website and will be updated as signatures from collaborating organizations become available and as conditions dictate.

RESEARCH

Three Apacheria Fellowships Awarded!



"In the summer of 2016 I surveyed the diet and morphology of ten populations of the ornate tree lizard along a latitudinal gradient from the Appleton-Whittell Research Ranch in southern Arizona to Capitol Reef National Park in central Utah. Using stable isotope analysis, I am able to discern the trophic position of the ornate tree lizard and how it varies geographically. I will also use this information to elucidate how trophic position shifts in response to changes in vegetation and competition. The Apacheria Fellowship allowed me to camp throughout Arizona and Utah as I visited sites as well as stay at the Appleton-Whittell Research Ranch while sampling southern Arizona." **William Ternes** – Masters Student, Christopher Newport University.

"I am trying to understand how lizards in arid, desert environments can adapt to changing environments caused by climate change. An Apacheria fellowship during the summer of 2016 was instrumental in allowing me to complete a portion of my dissertation work, looking into how different throat-color morphs of tree lizards differ in physiology, and their susceptibility to climate change." **Anthony Gilbert** – Ph.D. Candidate at Ohio University - presented results of his work at the 8th Annual Science on the Sonoita Plain Symposium.



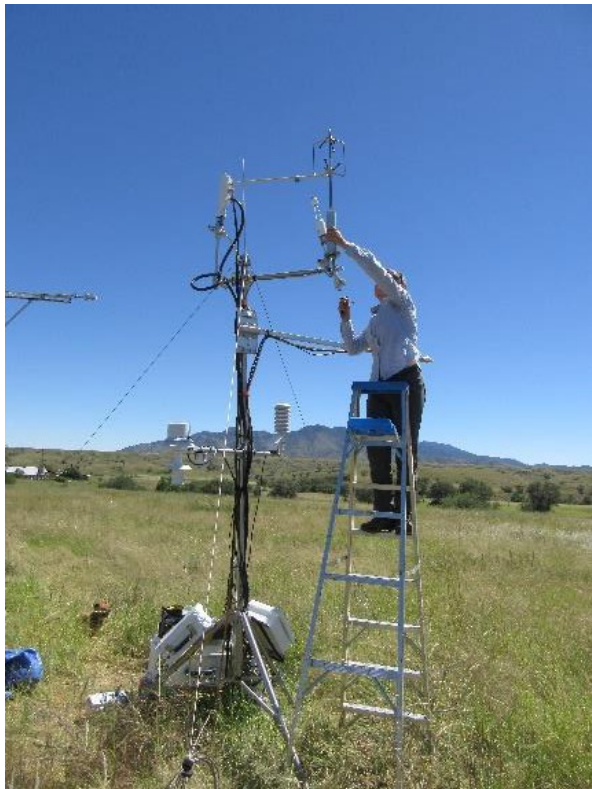
Cynthia Morris, an undergraduate studying at Christopher Newport University, was awarded an Apacheria/Fleharty Fellowship to examine the causes of escape behavior variation of *Urosaurus ornatus* to develop a better understanding of the complex ecological dynamics in this species. Her results will be informative to our understanding of this species as well as others, especially in terms of how behaviors not tied to competition (e.g., escape behavior) might overwhelm competitive differences among males.

Herpetologists dominated the competition for fellowships in 2016, but thanks to a donation from **Huachuca Audubon Society** we will offer a fellowship specifically for a student research project on avian ecology in 2017. Other donations will support a Apacheria/Fleharty fellowship and an Apacheria Fellowship!

2016 was another busy year for science on AWRR – the list of “Active” projects stands at 81 (see below); 47 of these projects included on-the-ground activity here on the Research Ranch during 2016. The active list includes projects from nine federal or state agencies, five NGOs or L3Cs, six individuals or LCCs, and twenty academic institutions, including two high schools.

Summary of Active* Research/Monitoring Projects Associated with AWRR

**One or more of following: Proposal approved but project not commenced; Field work/research within past two years; Publication received within past two years; Publications pending; Publications in demand within past two years; Projects with return intervals >1 year; Collaborative, long term efforts.*



Inter-compatibility of AmeriFlux Sites (photo at left). AmeriFlux Network Tech Team (ameriflux.lbl.gov), Lawrence Berkeley National Laboratory, Berkeley, CA; Sebastien Biraud, Dept Head; Sigrid Dengel, Field Technician. See also NOAA. Project: Compare NOAA system at AWRR with roving eddy covariance system. Application: Maintain high standard of inter-comparability between AmeriFlux Sites.

Effect of mesquite cover on avian diversity, density and reproductive success in desert grasslands. Erik Anderson and Dr. Robert Steidl. SNRE, University of Arizona. Subject: Sites on Research Ranch used as control/reference compared to grazed grasslands. Applicability: Better understanding of ecological processes driving grassland ecosystems and aid development of sound management practices.

Northern Mexican Gartersnake Management.

Arizona Game & Fish Dept. (AZGF): Tom Jones, Roger Cogan & Linda Kennedy, Volunteers, covered under AZGF Section 6 authority to manage federally threatened species. Subject: Observe Mexican Gartersnakes. Application: Document sightings of federally threatened species under coverboards and other likely sites.

Fish Surveys. AZGF (photo at right). Subject: Conduct periodic surveys of the riparian systems of the Research Ranch and neighboring properties. Application: Evaluate stability of populations, recommend management actions.



Pupfish Reintroduction. AZGF. Ross Timmons; USFWS, Doug Duncan; BLM, Jeff Simms. Subject: Monitor and protect population of pupfish introduced into ranch stockponds and wildlife waters. Application: Conserve native species.

Pronghorn Survey. AZGF, Brad Fulk; Arizona Antelope Foundation, John Millican; Audubon staff. Project: Ground survey of Pronghorn on AWRR and document sightings in region. Application: Data pooled to estimate population size and corridors used.



Survey of Gould's Turkeys near Huachuca Mountains. AZGF, Brittany Oleson; Audubon staff. Project: Estimate populations. Application: Track success of re-introduction effort.

Avian Monitoring for Research Ranch IBA. Audubon staff: Tice Supplee, (Audubon Arizona). Project: Monitor bird species on AWRR. Application: Support IBA nomination, examine long-term trends.

Bullfrogs, Monitoring and Removal. Audubon Staff and volunteers. Subject: Discover and eradicate individuals within boundary of AWRR. Application: Protect native fish, reptiles and amphibians from predatory, non-native species.



Christmas Bird Count – Appleton Whittell Circle. Audubon staff: Suzanne Wilcox & Tony Leonardini (Volunteer) Co-compilers since 2015. Subject: Conduct bird count as per Audubon standards. Application: Pooled data yield important information re avian populations, movement and trends. Results of 2015 CBC (held 1/3/2016): 105 species; 2726 individual birds! The 2016 AWCBC will be Jan. 3, 2017.

Depth to groundwater on Research Ranch. Audubon Staff-Roger Cogan, Tony Leonardini (Volunteer). Project: Monitor the depth to groundwater of the wells on Research Ranch. Application: Determine seasonal and annual trends.

Ecological Site Monitoring (ESM)/ aka Upland Vegetation Monitoring. Audubon Staff: Linda Kennedy (photo, right). Project: Establish permanent points to monitor vegetation change. Application: Identify trends in vegetation change.

Geographic Information System
Audubon Staff: Suzanne Wilcox. Project: Map research, monitoring, conservation sites. Application: Archival, management, research support.



Precipitation at Ecological Sites. Audubon Staff. Project: Rain gages to correspond with ESM monitoring sites. Application: Correlate precipitation with changes in vegetation.

Wild Turkeys on the Research Ranch. Audubon Staff. Project: Record sightings of wild turkeys. Application: Document spread of sub-species reintroduced in Huachuca Mtns.

Effects of fire and climate change on mesquite. Audubon Staff. Project: Monitor the effects of fire and climate change on mesquite. Application: Baseline information for future research, identify trends, aid management decisions.

Effects of fire and climate change on cacti. Audubon Staff. Project: Monitor the effects fire and climate change on native cacti. Application: Baseline information for future research.

Small mammal populations on the Appleton-Whittell Research Ranch. Audubon staff and volunteers. Project: Develop long-term monitoring program. Application: Indicate trends in small mammal populations.



Monarch Sightings. Audubon Staff. Project: Document sighting of Monarchs and report to Southwest Monarch Study. Application: Advance knowledge of phenology, food sources of species.

Yellow-billed Cuckoo Surveys. Audubon Staff: Steve Prager (Audubon AZ), Tony Leonardini (volunteer). Project: Search for this federally threatened species using USFWS protocol. Application: Document presence and habitat use on AWRR.

Survivorship of Riparian Trees in the Southwest. Carl & Jane Bock. University of Colorado. Project: Resurvey the riparian trees tagged in the 1980s. Application: Determine the survivorship of native trees after fires, flood and drought.

Agave Site Monitoring. BLM, Kristen Duarte; and University of Arizona, Cochise Co. Extension, Kim McReynolds. Project: Establish permanent transects to monitor agave numbers, class and herbivory. Application: Ungrazed land to function as control to examine impacts of domestic livestock.

Assessing condition of O'Donnell Creek. BLM. Jeff Simms, Nate Dietrich. Project: Use Proper Functioning Condition Standards to evaluate condition of O'Donnell Creek. Application: Environmental Assessment.

Population dynamics and habitat characteristics of Montezuma (Mearn's) Quail in southeastern Arizona. Pedro Mazier Chavarria, Ph.D., Northern New Mexico University. Subject: Monitoring movement of quail. Application: Fill knowledge gaps about life history and determine how behavior and genetic viability is affected in areas where hunting is, and is not, allowed.

Annotated Bibliography of Lehmann Lovegrass. Richard Adam Chasey. San Francisco State University
Project: Gather all known publications associated with non-native, invasive *Eragrostis Lehmanniana*
Application: Aid to research and management.

Arizona Tree Frog documentation. Roger C. Cogan, Conservation Program Manager, AWRR. Project: Discovered amphibian species new to AWRR. Document all sightings. Application: Species was candidate for federal listing. (photo, right)



Survey of herpetofauna (reptiles and amphibians) including den sites of Crotalids on the Research Ranch. Roger C. Cogan, Conservation Program Manager, AWRR. Project: Document sightings of herps and monitor winter den sites Application: Determine whether unrecorded species are on AWRR and if species earlier recorded are extant, plus document sites of critical importance to rattlesnake survival.

Use of Cover Boards to Locate and Monitor Reptile Species. Roger C. Cogan, Conservation Program Manager, AWRR. Project: Distribute and monitor coverboards across AWRR. Application: Evaluate technique to further baseline knowledge about reptiles.

History of the Lands in the National Audubon Society's Research Ranch Near Elgin, in Santa Cruz County, AZ. Glendon Collins. BLM (retired), Arizona State Trust Lands (retired). Subject: Compile and document history of land transactions involving federal and state lands. Application: Background.

Honeybee communication and the ecological context. Matina Donaldson-Matasci, Ph.D. Assistant Professor. Harvey Mudd College. Project: Explore relationship between resource distribution and value of communication. Application: Basic science on species.

Current Distribution and Status of Slevin's Bunchgrass Lizard, *Sceloporus slevini*, in southeastern Arizona. Christian d'Orgeix, Ph.D.; Virginia State University; Petersburg, VA., Project: Survey for bunchgrass lizard. Collect tissue for DNA analysis to compare intrapopulation and interpopulation genetic variance. Application: foundation for determining genetic relatedness of different populations and effects of bottlenecks on populations.

Survey of Appleton-Whittell Research Ranch Drainages and Ponds for the Mexican Garter Snake. Christian d'Orgeix, Ph.D.; Virginia State University; Petersburg, VA. Project: Survey for presence of Mexican garter snakes (Telles tank, O'Donnell Canyon, Post Canyon), and conduct long-term study of population at Finley tank. Application: Management implications for federally listed species.

Optimal Foraging in Harvester Ants. Christian H. d’Orgeix, Blacksburg High School, Blacksburg, VA. Project: Examine the role of seed size in foraging behavior. Application: Results will assist in determining the ecological rise of ants in the environment.

Genetic approach for using pollen to determine plant resources used by nectarivorous bats. George Ferguson, University of Arizona, Tucson AZ. Project: Collect tissue samples from *Agave parryii* v *huachucaensis*. Application: Determine usage of this species by Lesser Long Nosed Bats (Endangered Species).

Using soil moisture to assess ecosystem function following exotic lovegrass invasion in semiarid grasslands of southeastern Arizona. Alexander G. (Sam) Fernald, Ph.D., New Mexico State University; Cross Anne F., Ph.D.; Tulsa OK. Project: Measure soil moisture under Plains lovegrass (*Eragrostis intermedia*), a native species, and Lehmann lovegrass (*E. lehmanniana*), an exotic species. Application: Determine whether a semiarid grassland retains its functional integrity following the invasion of an introduced, exotic grass.



DNA Analysis of *Asclepias uncialis*. Mark Fishbein, Ph.D, Oklahoma State University. Project: Perform DNA analysis on leaf tissue removed from *A. uncialis*. Application: Inclusion within large scale phylogenetic study of milkweeds.



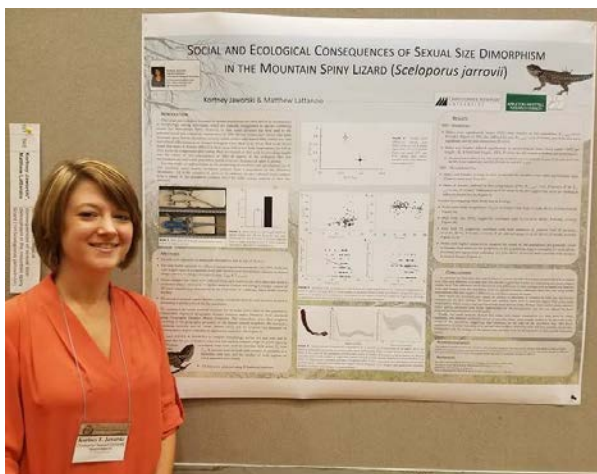
Merging functional ecology and phylogenetics to predict the response of grasslands to global change. Elisabeth Forrestel, Melinda Smith, Ph.D., Yale. Project: Compare natural grassland sites across broad precipitation gradients in North America, Australia and South Africa. Application: Provide evolutionary history and functional biology of ecologically and economically important grass species.

Ecological and evolutionary responses of lizards to resource limitation. Anthony Gilbert. Ohio University. Project: Quantify how resource limitation impacts lizard performance, fitness and social dominance. Application: Furthering knowledge of how lizards may respond to anthropogenic disturbances such as climate change. (Shown at right with Suzanne Wilcox, AWRR office manager.)



Research Ranch boundary surveying and mapping. Dale Greene and Kristen L. Greene. Dk Greene Consulting, Inc. Bonsall, CA. Project: Survey and map Audubon property boundary and certain water catchments. Application: 1) The exact perimeters of property owned by Audubon will be determined with up-to-date equipment and marked for posterity. 2) Location and physical characteristics of artificial water catchments will be determined and compared to existing records.

Survey of high desert grasslands Hymenoptera. Eric Grissell, Sonoita, AZ; Project: Study insect diversity in southwest. Application: Significant contribution to state of knowledge.



Linking individual behavior, microhabitat use, and spatial population structure with fitness. Kortney Jaworski. Christopher Newport University. Project: Study behavior of adult male mountain spiny lizards (*Sceloporus jarrovi*). Application: Insight onto the relationship between individual traits and population spatial structure and influence upon fitness. Jaworski, at left, presenting poster at Joint Meeting of Ichthyologists and Herpetologists.

Camera-trap Network. Greg Joder. Tucson, AZ. Project: Collect photographs or video for archival purposes. Application: Augmentation of research, ecosystem conservation and education/outreach goals of AWRR.

Photo-herbarium for the Research Ranch. Linda Kennedy, Director, Research Ranch. Project: Document life stages of plant species found on the Research Ranch. Application: Baseline information for future research; Aids identification.

Sacaton Rehabilitation. Linda Kennedy, Director, AWRR. Project: Re-establish *Sporobolus wrightii* in appropriate degraded sites. Application: Improve wildlife habitat, bioremediation of sites dominated by exotic, invasive Bermudagrass.

Passive surveys of Yellow-billed Cuckoos. John Kraft, Coronado National Forest, and Tony Leonardini. Project: Place bioacoustic recorders along established avian transects. Application: Test passive survey techniques to monitor this federally listed species.



Oak (*Quercus*) water use strategies in Sky Island Systems. Russell Lackey; Texas Tech University, Lubbock, TX. Project: Determine physiological drought tolerance of native oak species. Application: Explain current patterns in community composition/distribution in relation to water balance.

Modeling impacts of habitat alterations on habitat use and diet selection of desert reptile communities. Matt Lattanzio, Ph.D., Christopher Newport Univ. VA. Project: Determine how



management practices and climatic variability affect resource availability and use by grassland reptiles. Application: Management practices may be altered to enhance habitat and use.

Lattanzio demonstrating study techniques to Sonia Perillo, Audubon Arizona Executive Director.

Avian Survey/Monitoring on the Research Ranch. Tony Leonardini, Volunteer, Appleton-Whittell Research Ranch. Project: Document avian species composition and population size. Application: Baseline information and trends. Develop database to track and archive data. Lesser yellow-legs, below, photo courtesy of Leonardini.



Flora of the Appleton-Whittell Research Ranch. Steven P. McLaughlin, Ph.D., University of Arizona, (Ret.) Tucson AZ, Erika L. Geiger; USGS; Janice E. Bowers; U.S. Geological Survey (Ret). Project: Compile a flora—a complete list of all flowering plants, ferns, and conifers on AWRR. Application: Baseline for ongoing and future research.

Flora of Upper O'Donnell Canyon. Kathryn Miller. Patagonia Union High School. Project: Collect plant specimens at TNC's Canelo Hills Cienega Preserve. Application: Creation of flora and herbarium for CHCP will establish baseline presence via voucher specimens. Duplicate specimens lodged at AWRR herbarium.

Factors affecting variation in the escape behavior of *Urosaurus ornatus*. Cynthia Morris, Christopher Newport University, Newport News, VA. Project: Examine causes of escape behaviors in relation to social dominance. Application: Add to body of knowledge of complex ecological dynamics of this species.

The Effects of Fire and Grazing on Grassland Bird Diversity and Abundance in an Arizona Oak-Savanna Clay Nichols, Eastern New Mexico University, Portales, NM. Project: Re-survey bird diversity on oak transects established by Bock & Bishop after Ryan fire. Application: Provide information, long-term, on effect of wildfire on avian diversity and abundance.

Long-term meteorological, evaporation and carbon flux measurements. NOAA: National Oceanic & Atmospheric Administration; Tilden P. Meyers, Ph.D. Meteorologist; Oak Ridge, TN, John Hughes, Asheville, NC. Subject: Establish a Climate Reference Network site – to characterize the water and carbon balance for typical ecosystem for arid southwest grasslands. Application: These data will be used to improve the current land use models for climate change.”

Impacts of grazing, fire and precipitation variability on woody plant cover in Chihuahuan Desert grasslands, USA. Kelley O'Neal, Department of Geography, University of Maryland, College Park, MD. Project: Quantify changes in woody plant cover, map occurrence of grazing, fire and precipitation using (in part) Landsat and MODIS satellite data. Application: Identify trends, develop methodology.



The Babacomari Restoration Project. H. Ron Pulliam, Ph.D. Borderlands Restoration, L3C. Patagonia AZ Subject: Re-establish avian plots from 1970s & 1980s to serve as control/reference areas. Applicability: Evaluate effectiveness of rehabilitation efforts on Babacomari Cattle Ranch. Pulliam (left) presenting at the 2016 Science on the Sonoita Plain symposium.

Babocomari River Protection. Daniel G. Robinett, Robinett Rangeland Resources, Elgin, AZ; Donna Mathews, Coronado RD & D., Inc. Willcox, AZ. Project: Establish transects and monitor streamside conditions of Babocomari River, O'Donnell and Turkey Creek for 5 years. Application: Results will enable sound management decisions to maintain and/or improve vegetation conditions on Babocomari watershed. Will have application to other desert rivers.

Effects of the Ryan Wildfire (April 2002) on Wintering Grassland Birds in the Sonoita Valley, Arizona. Janet M. Ruth, Ph.D., USGS (retired, 2016). Project: Compare pre-fire data collected on the Audubon Appleton-Whittell Research Ranch in 1999-2001 with post-fire data collected on the same transects and plots. Application: Evaluate the effect of wild fire on wintering avian abundance/densities and vegetation structure/composition in desert grassland habitats.

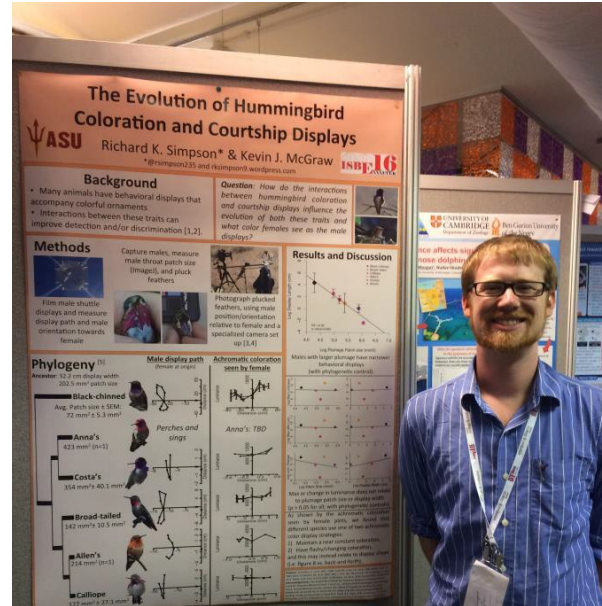
Wintering habitat use by priority grassland birds. Janet M. Ruth, Ph.D., USGS (retired, 2016). Project: How do high priority grassland birds use habitats during the winter season? How is winter habitat use affected by land use practices such as grazing? Application: Aid in land management decisions to provide habitat.

Distribution and abundance of breeding Arizona Grasshopper Sparrow (*Ammodramus saviarum ammolegus*), and associated priority grassland species, throughout its known range in the Southwest U.S. Janet M. Ruth, Ph.D., USGS (retired, 2016). Project: Document current distribution and abundance of Arizona Grasshopper Sparrows and associated priority grassland bird species. Test methodologies. Application: Understanding status and distribution, population trends, ecology and habitat relationships is essential for conservation of avian species of concern.

Continuously Monitor Groundwater Levels. Andrew Salywon, Ph.D., Desert Botanical Garden, and R.J. Tiller, Ph.D., Phoenix, AZ. Project: Install pressure transducers in wells and piezometers in Las Cienegas NCA. Application: Enhance ability to record temperature, water depth and data sharing capability.

Evolution of Hummingbird Visual Traits.

Richard (Rick) Simpson, at right. Arizona State University, Tempe, AZ. Project: Film male hummingbird courtship displays and measure plumage coloration. Application: Understand the mechanisms by which multiple ornaments evolved.



Huachuca Water Umbel seed bank study. Juliet Stromberg, Ph.D. and Kara Barron. Arizona State University. Project: Sample for viable seed in sites known to harbor HWU (Federally listed species). Application: Add to body of knowledge re protected species under auspices of USFWS. Barron on the left in photo, below.



Wet-Dry Mapping. The Nature Conservancy/Canelo Hills Cienega Preserve. Project: Map extent of open water in O'Donnell Canyon. Application: Track the health of the San Pedro River by monitoring surface water

Factors Driving Trophic Niche Variation in a Widespread Lizard. William (Will) Ternes, Christopher Newport University, Newport News, VA. Project: Test diets of 10 populations of *Urosaurus ornatus* (Ornate tree lizard). Application: Characterize mechanisms that may contribute to variation among populations. Ternes, at right, presenting at the 2016 Joint Meeting of Ichthyologists and Herpetologists in New Orleans (photo credit, Kortney Jaworski).



Research and reintroduction effort for Huachuca Water Umbel. Jonathan H. Titus, Ph.D., SUNY-Fredonia, Fredonia, NY, Priscilla Titus, Fredonia NY. Project: Transplant plugs and monitor success. Application: Protect listed species, aid in development of recovery plan for species.

Bluebird and Climate Watch Pilot Study. Tucson Audubon Society, Jennie Macfarland (TAS Bird Conservation Biologist), Lead. Tony Leonardini (AWRR volunteer). Project: Conduct annual surveys of Bluebirds per NAS protocol. Application: Document species' response to climate change on large scale.

Conservation Effects Assessment Project on the Cienega Creek Watershed. USDA-ARS, SWRC, David C. Goodrich and Haiyan Wei. Tucson, AZ. Project: Use data from the Research Ranch (see Audubon Ecological Site Monitoring) as control. Application: Quantify the benefits of conservation management and practices.

Meteorological Station. USDA-ARS; Southwest Watershed Research Center; Tucson, AZ. Project: Station jointly owned by AWRR & USDA. Application: Baseline information on climate available to researchers and land managers of region.

Inventory of ecological sites, their present day condition, trend and rangeland health. USDA. –N.R.C.S. Dan Robinett, Don Breckenfeld, (Both Retired) Tucson, AZ. Project: Map ecological sites on AWRR and compared present day plant communities to what site guides show as potential for MLRA 41. Application: Baseline information for future research and land management. Control area for comparison by ranch managers.

Soil inventory update. USDA-NRCS Donald J. Breckenfeld, Daniel Robinett; (both retired) Tucson, AZ. Project: A soil inventory update that coincides with soil surveys that have been done elsewhere in southern Arizona – updating the old soil survey to the new soil series and map units used in MLRA 41-1. Application: Baseline information needed by other research projects.

Natural Resources Inventory – Primary Site Unit USDA-NRCS. Tucson, AZ. Emilio Carrillo (2004), Christine Egen (1992), Steve Barker (1982). Project: Transects established in 1982, to be resampled on approximately decadal basis. Application: Identification of trends – reference area for MLRa-41.

Rangeland Health Reference Areas. USDA-NRCS. Tucson Soil Survey Office. Tucson, AZ. Wilma Renken, Ecological Site Inventory Specialist. Project: Determine reference areas for Ecological Sites Descriptions in MLRA-41 (high functioning rangelands with minimal human and livestock impacts). Application: Reference areas used to support rangeland health descriptions in 2-3 million acres of SW.

National Soil Health & Sustainability. USDA-NRCS. Heather Dial. Tucson Plant Materials Center. Project: Haney Soil Test on loamy upland, sacaton bottom, Boer monoculture. Application: Reference for comparison through time and against other land uses.

Terrestrial Ecosystem Unit Inventory. USFS. Patricia Boness, (field lead), David Watson (soil scientist), Wayne Robbie (Albuquerque Regional Field Office). Project: Map soils and vegetation/Coronado NF



Progress Field Review of CNF lands within AWRR. Application: Include in FS-wide effort to classify ecosystem types and map ecological units at different spatial scales. (Right)

Agave Monitoring on the Coronado National Forest

USFS. Project: Monitor impacts of livestock grazing on florivory of agave. Application: Management of food source for lesser long-nosed bat.

***Pectis imberbis* surveys.** USFS. Julie Crawford. Project: Survey reported sites. Application: Information on species that may become federally listed.

Inventory of native plant-feeding insects Arizona.

Alfred G. Wheeler (right), Clemson University, Clemson, SC. Project: Collect insects that feed on *Eragrostis* spp. and other plants to identify species, and compare species composition with collections from NM, OK and TX. Application: Baseline information on species occurrence and host plants.

Ground Beetle (Coleoptera: Carabidae) assemblage responses to fire in southern Arizona.

Corynne A. Wright, Christopher Newport University, Newport News VA. Project: Study Carabid diversity at four sites with varying fire histories. Application: Contribute to understanding of how ground beetle assemblages respond to fire and habitat succession.

Pollination without a keel: an investigation of floral form change in the genus *Dalea* (Fabaceae).

Justin Zweck, Saint Louis Univ. St. Louis MO.

Project: Compare pollination biology of *Dalea* species with “closed” and “open” floral forms.

Application: May encourage planting of specific *Dalea* species to serve as host plants for pollinators that are important for legume crops.



PUBLICATIONS ASSOCIATED WITH THE RESEARCH RANCH

To Be Published In 2017

- Archer, SR, EM Andersen, KI Predick, S Schwinning, RJ Steidl, and SR Woods. 2017. Woody plant encroachment: causes and consequences *in* Rangeland systems: processes, management, and challenges, DD Briske, editor. Springer International Publishing.
- Arnold, AE, EM Andersen, MJ Taylor, and RJ Steidl. 2017. Using cytochrome *b* to identify nests and museum specimens of cryptic songbirds. Conservation Genetics Resources (in press)
- Chavarria, P. M., N. J. Silvy, R. R. Lopez, D. S. Davis, and A. Montoya. 2017. Seasonal range and movements of Montezuma quail in SE Arizona. Proceedings of the National Quail Symposium 8 (*accepted*), July 24, 2017
- Chavarria, P. M., N. J. Silvy, R. R. Lopez, D. S. Davis, and A. Montoya. 2017. Survival demographics of Montezuma quail in southeast Arizona. Proceedings of the National Quail Symposium 8 (*accepted*), July 24, 2017

Received and/or Published in 2016

- Albrecht, Lois and Linda Kennedy. 2016. Native Plants for Hummingbird Gardens: A Pocket Guide. 2nd Edition. 68 pages.
- Andersen, Erik M. and Robert J. Steidl. 2016. Effects of Non-Native Grasses on Density and Nest Success of Birds in the Desert Grasslands. Oral presentation to the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 23 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp .2016 final.pdf)
- Bock, Carl E., and Jane H. Bock. 2016. The Ecology and Possible Control of Lehmann Lovegrass (*Eragrostis lehmanniana*) in the American Southwest. Oral presentation to the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pgs 17-20 of Proceedings. http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp .2016 final.pdf)
- Duncan, Doug. 2016. Implementation of the Topminnow and Pupfish Safe Harbor Agreement at the Appleton-Whittell Research Ranch of Audubon. 2016. Oral presentation to the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 15-16s of Proceedings. http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp .2016 final.pdf)
- Forrestel, Elisabeth J., Michael J. Donoghue, Erika J. Edwards, Walter Jetz, Justin C.O. du Toit, and Melinda D. Smith. 2016. Different clades and traits yield similar grassland functional responses. Proceedings of National Academy of Sciences. www.pnas.org/cgi/doi/10.1073/pnas.1612909114. Early Edition Pgs 1-6.
- Gilbert, Anthony L. and Matthew S. Lattanzio. 2016. Ontogenetic Variation in the Thermal Biology of Yarrow's Spiny Lizard, *Sceloporus jarrovi*. PLoS ONE 11(2): e0146904. Doi:10.1372/journal.pon.0146904
- Gilbert, Anthony L. and Donald B. Miles. 2016. Food, temperature and endurance: effects of food deprivation on the thermal sensitivity of physiological performance. Functional Ecology (doi: 10.1111/1365-2435.12658

- Gilbert, Anthony. 2016. Ecological and Evolutionary Responses to Temperature: How Ornate Tree Lizards will Respond to Climate Change. Oral presentation to the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 10 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp.2016.final.pdf)
- Jaworski, Kortney and Matthew Lattanzio. 2016. Social and ecological consequences of sexual size dimorphism in the mountain spiny lizard (*Sceloporus jarrovi*). Poster presentation to the 2016 Joint Meeting of Ichthyologists and Herpetologists. July 10, 2016. New Orleans, LA. Book of Abstracts: Pg 308.
- Kennedy, L.J., R.C. Cogan, S.L. Wilcox. 2016. Protecting the Prairies One Squirt at a Time. Poster presentation at the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 31 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp.2016.final.pdf)
- Kennedy, L.J., R.C. Cogan, S.L. Wilcox. 2016. Whitetop - What to call this species is a challenge and management of this species is even worse!. Poster presentation at the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 32 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp.2016.final.pdf)
- Krohmal, Kylie and Matthew Lattanzio. 2016. Male mate choice in the color polymorphic lizard, *Urosaurus*. Poster presentation to the 2016 Joint Meeting of Ichthyologists and Herpetologists. July 10, 2016. New Orleans, LA. Book of Abstracts: Pgs 342. **Victor Hutchison Student Poster Award**
- Lattanzio, Matthew. 2016. Diet shifts and the morphological responses of tree lizards to recent climate change. Oral presentation to the 2016 Joint Meeting of Ichthyologists and Herpetologists. July 10, 2016. New Orleans, LA. Book of Abstracts: Pg 351.
- Lattanzio, Matthew. 2016. Trophic niche divergence among color morphs that exhibit alternative mating tactics. Poster presentation to the 2016 Joint Meeting of Ichthyologists and Herpetologists. July 10, 2016. New Orleans, LA. Book of Abstracts: Pgs 351-352.
- Lattanzio, Matthew S. and Donald Miles. 2016. Stable carbon and nitrogen isotope discrimination and turnover in a small-bodied insectivorous lizard. *Isotopes in Environmental and Health Studies*, DOI: 10.1080/10256016.2016.1154854
- Leonardini, Tony. 2016. Avian Survey at the Research Ranch. Poster Presentation at the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 28 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp.2016.final.pdf)
- Miller, Kathryn. 2016 Canelo Hills Cienega Preserve Herbarium and Flora. Poster at the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 30 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp.2016.final.pdf)
- Prager, Steve. 2016 Breeding Habitat of the western distinct population of the yellow-billed cuckoo (*Coccyzus americanus*) within Audubon Arizona Important Bird Areas . Poster to: Arizona Chapter of the Wildlife Society, The 49th Joint Annual Meeting , Feb 4-6, 2016. Flagstaff, AZ and to the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 27 of Proceedings

http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp_2016_final.pdf)

- Pulliam, H. Ronald. 2016. The Spread of Exotic Grasses and Decline in Grassland Sparrows: What can we do about it? Oral presentation to the 8th Annual Science on the Sonoita Plain Symposium, June 4, 2016. Elgin, AZ (abstract on pg 13 of Proceedings http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp_2016_final.pdf)
- Simpson, R.K. and K.J. McGraw. 2016. The Evolution of Hummingbird Coloration and Courtship Displays. Poster presentation. Society for Behavioral Ecology - July 28- August 2, 2016; Exeter, UK; Pages 84,85. International <http://www.isbe2016.com/>
- Simpson, R.K. and K.J. McGraw. 2016. The Evolution of Hummingbird Coloration and Courtship Displays. Oral Presentation. Arizona Field Ornithology - October 21-23, 2016; Yuma, AZ; Page 1. http://www.azfo.org/annual_meetings/MeetingPage_2016.html
- Taylor, Julie and Matthew Lattanzio. 2016. Blue gets the boulder, but yellow is bolder: territorial dynamics of a color polymorphic lizard. Poster presentation to the 2016 Joint Meeting of Ichthyologists and Herpetologists. July 10, 2016. New Orleans, LA. Book of Abstracts: Pg 622. **Victor Hutchison Student Poster Award.**
- Ternes, William and Matthew Lattanzio. 2016. Factors driving trophic niche variation in a widespread lizard. Poster presentation to the 2016 Joint Meeting of Ichthyologists and Herpetologists. July 10, 2016. New Orleans, LA. Book of Abstracts: Pgs 622-623. **Victor Hutchison Student Poster Award.**
- Wilcox, Suzanne (Compiler). 2016. Proceedings of the 8th Annual Science on the Sonoita Plain Symposium. June 4, 2016. http://researchranch.audubon.org/sites/g/files/amh846/f/static_pages/attachments/proceedings.sosp_2016_final.pdf. 32 pages.



CONSERVATION

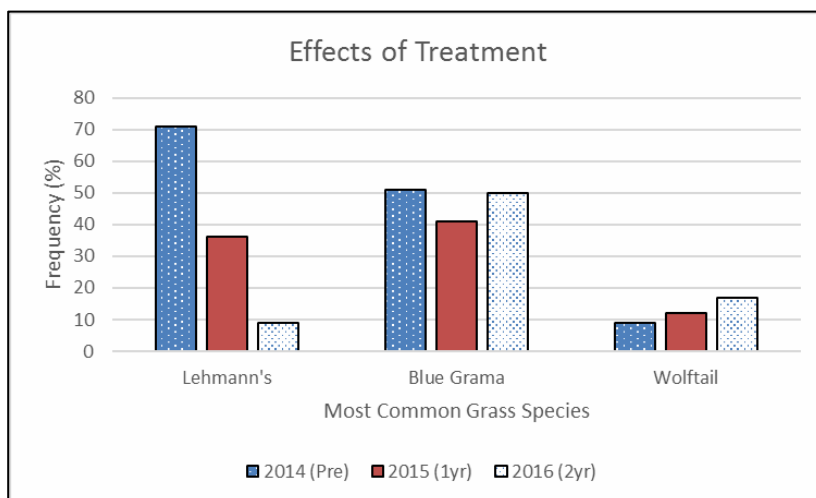
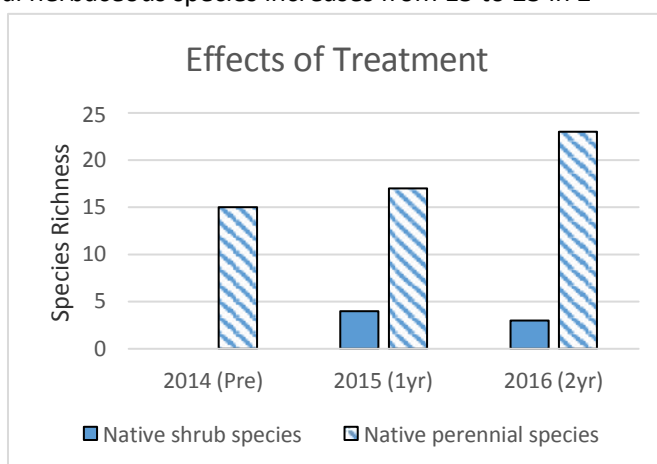
TREATMENT OF INVASIVE, NON-NATIVE GRASSES: When monitoring data show that non-native species are not measurably increasing in an area where you are actively treating for maintenance – you feel good. When monitoring shows that your actions in another site have taken the frequency of Lehmann Lovegrass from 71% to 9% in just 2 years – you feel great. When that same monitoring shows you can do this level of treatment without negatively impacting native grasses – you are relieved. When these data show that species richness of native perennial herbaceous species increases from 15 to 23 in 2 growing seasons – you are pleased. When ranchers comment about the health and dominance of native grasses in the treatment areas - you know you are having a visible impact!

These two graphs show what can happen in just 2 years of intensive effort. Before receiving grants from Arizona State Forestry and Fire Management (IPG-13-701 and PTP-14-901), non-native Lehmann lovegrass dominated the area of this transect, 15 species of native perennials were present, and there

were no woody subshrubs (upper graph). After only 2 years of treatment, total species richness of native perennials rose to 23 and several native shrubs had become established in the area monitored.

Frequency of Lehmann lovegrass plummeted without concomitant decline in native grasses, which indicates that the decline in Lehmann was not due to climate or weather patterns, and that our treatment methods did not negatively impact native species (lower graph).

Both grants also provided support to treat infestations of White-top (*Cardaria draba*) in O'Donnell Canyon.



Among the interested parties that visited the Research Ranch to see this project were Allen White, Ph.D., Regional Pesticide Specialist, USDA-U.S. Forest Service, Albuquerque, NM and the members of the Sentinel Landscape Restoration Partnership.

REMOVAL OF NON-NATIVE BULLFROGS: Almost absent this year – only two were found and eliminated.

REHABILITATION EFFORTS FOR DESERT PUFFISH: All three populations (Headquarters, Bald Hill, and Antelope/Pronghorn) of this federally listed species are doing well.



REHABILITATION EFFORTS FOR CHIRICAHUA LEOPARD FROGS We were excited to find egg masses at both Bald Hill and Antelope Tanks this year and monitoring efforts by Cogan (at left) indicated successful reproduction at both sites.



In September AZGF biologist Hunter McCall released a Chiricahua Leopard Frog egg mass in the Headquarters Pond– we won't know until spring whether this release was successful.

SACATON GRASSLAND REHABILITATION: Thanks to continued financial support from the RIESTER Conservation Foundation and field assistance from a hardworking team from the Sierra Club Service Program, we were able to transplant over 200 native sacaton plants into the Post Canyon floodplain dominated by non-native Bermudagrass this year!



OTHER CONSERVATION

PROJECTS: The Sierra Club group didn't stop with the sacaton fence project, they also removed more fence that posed a danger to wildlife, helped maintain defensible (FireWise) space around all buildings, and constructed erosion control features along roads.

Plans are moving forward to rehabilitate three wetland sites in 2017. This project is a joint operation with US Fish and Wildlife Service Partners

Program, Sky Island Alliance, and Borderlands Restoration. These sites will provide permanent water for wildlife and habitat appropriate for continued reintroduction of listed species.



EDUCATION AND OUTREACH

LIVING GENTLY ON THE LAND: Suzanne Wilcox takes the lead to organize our major educational effort



to reach local residents and inspire them to cherish and protect our environment (local in this sense means anyone within driving distance!). Eight times a year the AWRR hosts “Potlucks & Presentations” as a way to introduce the experts to the community. There’s just something special about breaking bread together, meeting new friends, catching up with “old” friends, following up with great topics and speakers – Well Done, Suzanne!

POTLUCKS AND PRESENTATIONS IN 2016



January 9 - **Research for USFWS at Midway Atoll (Laysan Albatrosses)** by Greg Joder (who also demonstrated his quad-copter, left).

February 13 - **Snails in the desert? Yep, Arizona is home to hundreds of gastropods** by Jeff Sorensen, Arizona Game & Fish Department.

March 12 – **Wells** by Gary Hix, Professional Geologist Specializing in

Hydrology, Water Well Consultant, In2Wells, LLC.

April 9 - **Avian Impacts of Shrub Encroachment** by Erik Andersen, University of Arizona.

May 14 - **Living with Rattlesnakes**, by Melissa Amarello, Advocates for Snake Preservation.

September 10 – **Monarchs**, by Gail Morris, Director of Southwest Monarch Study.

October 8 – **Grassland Plant I.D. for Everyone, except those that take boring technical stuff too seriously.** Presentation and book-signing event by Jim Koweek, Author.

November 12 – **Solar Cars and Technology** by Alain Chuzel & Linda Bozarth, SunCatSolar.

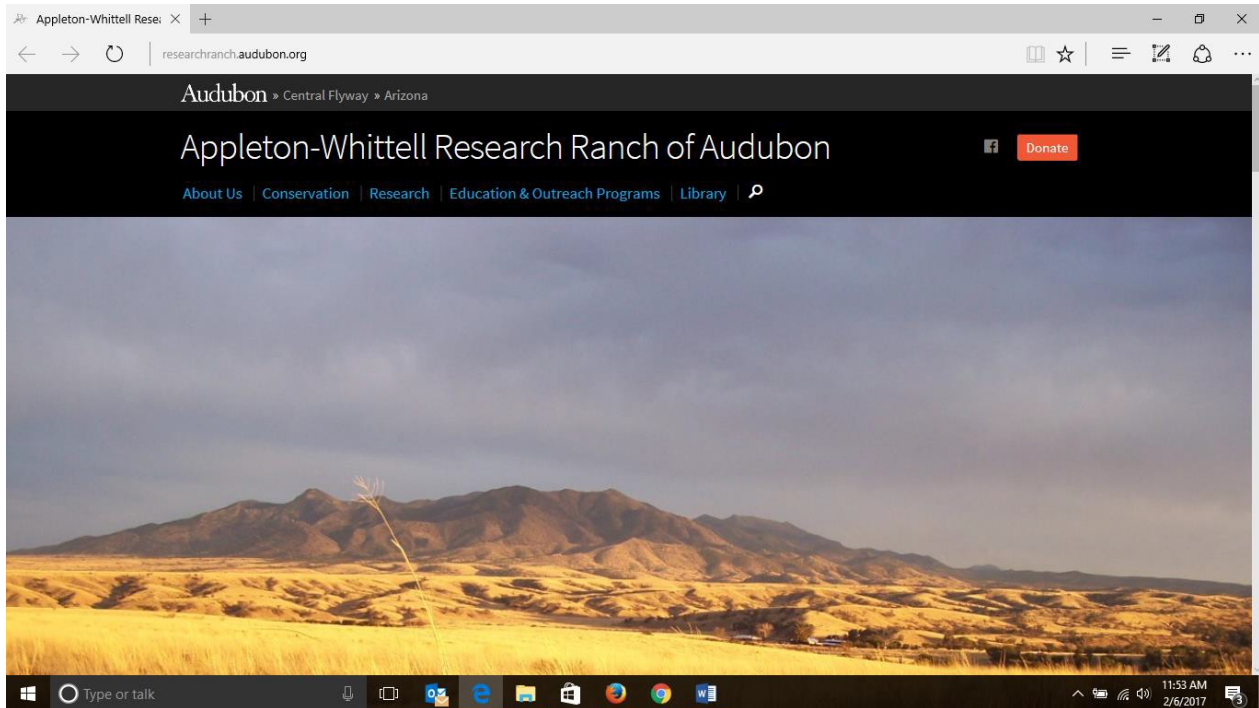
The **Science on the Sonoita Plain** annual symposium is another Outreach and Education effort for AWRR staff. Since its inception in 2008, this event – organized by volunteers from the Cienega Watershed Partnership, University of Arizona, The Nature Conservancy, Audubon, and others – has been held at AWRR, but may, in time, outgrow our facilities. The symposium brings scientists such as Dr. Carl Bock (above), agencies, land managers, and other



interested parties together to learn and share through presentations, scientific poster sessions, panel discussions, demonstrations, and networking during breaks. The proceedings of the 8th Annual Symposium can be downloaded from the library tab of the Research Ranch website.



And speaking of the AWRR website...it has been totally revamped. The format is now consonant with other National Audubon Society centers/sanctuaries and we can control the content of the AWRR website, rather than having to submit a request for changes. This means we will be able to update events and information much more handily. Suzanne Wilcox took on this monumental task and did a great job. Check it out at <http://researchranch.audubon.org>.



A 2nd edition of AWRR's 64-page booklet: *Native Plants for Hummingbird Gardens* was made possible thanks to the generosity of noted ornithologist, Jane Church, who remembered the Research Ranch in her will, and an anonymous donor. We now have over 2500 copies to distribute free-of-charge throughout Arizona, New Mexico and southern California.



This year AWRR was able to host Mrs. Koweek's 7th Grade Science Classes from Elgin School twice! Once in the spring and again in the fall. Cogan also served as judge at the Elgin School Science Fair.



FACILITIES

Only one major facilities issue in 2016: We knew the heating system in the Bunkhouse would need replacing eventually – but the decision was taken out of our hands this spring when the forced air furnace went on strike. We determined the repair parts were no longer available (yes, it was that old) so the decision was made to install a mini-split system similar to the one installed in the Swinging H Ranchhouse last year. This means the entire Research Complex (Bunkhouse, Swinging H Ranchhouse, Laboratory, Casita, and water well) is all electric. The PV solar array produces enough to offset the additional draw and we were able to return the propane tank to the dealer!

ADMINISTRATION

AUDUBON ARIZONA: The Research Ranch is part of the National Audubon Society's sanctuaries and centers network, and is administered through Audubon Arizona, based in Phoenix. Sonia Perillo joined our team in 2016 when she was named Executive Director of Audubon Arizona. How better to get acquainted with the Research Ranch than to spend time in the field with AWRR staff?



Wilcox, Perillo, Cogan (with snake stick!)

Audubon Arizona held a board retreat at the Research Ranch in the spring of 2016 and agreed to form a working group dedicated to the Research Ranch! The working group includes representatives from the ranching community, other non-profit organizations, researchers, along with board members. They are sharing their input and expertise to position AWRR strongly in the future.

Suzanne Wilcox (Office Manager) is now full-time! We are very pleased that the Research Ranch financial situation has improved enough to support this upgrade. However, the operating budget is not yet strong enough for her to work 40 hrs each week. This change in status does enable her to work up to 40 hours per week when funding from grants, contracts, or contributions is available.

As a follow up on the above, AWRR received a new type of contribution this year from Frederick Fernald (father of Sam Fernald and Anne Cross – see list of active research). Fred directed a distribution from his IRA to come directly to the Research Ranch! This unexpected boon will make it possible for AWRR to address a huge discrepancy in our role as a research facility – we have no one on staff who is GIS literate. Through Fred's generosity and Suzanne's new upgrade to full-time status, the Research Ranch will be able to take advantage of National Audubon Society's GIS program. Suzanne will begin training in January, 2017.

FINANCES: The following financial statements are from National Audubon Society's Audit, fy 2016.

NATIONAL AUDUBON SOCIETY, INC.
Research Ranch
Schedules of Activities - Research Ranch and Changes in Surplus Fund
For the years ended June 30, 2016 and 2015

	<u>2016</u>	<u>2015</u>
REVENUE		
Contributions	\$ 10,845	\$ 21,850
Bequests	10,226	-
Grants	7,771	6,004
Sales	75	-
Rentals	8,820	5,760
Pooled investment income - appropriated	199,876	201,014
Other income	21,630	7,290
Assets released from restrictions	12,575	5,000
Total revenue	<u>271,818</u>	<u>246,918</u>
EXPENSES		
Salaries and fringe benefits	173,740	157,296
Travel	103	-
Professional and consulting fees	855	1,615
Postage - general	81	296
Grants	-	1,500
Gas and electricity	1,969	1,623
Building and office maintenance	13,801	18,393
Telephone	4,830	4,664
Insurance	6,352	5,411
Maintenance - general, road and vehicles	2,046	6,420
Office and household supplies	2,846	2,202
Scholarships	1,250	-
Equipment rental	108	108
Furniture and fixtures	1,603	1,477
Computer equipment and software	607	572
Farm supplies	1,369	1,314
Printing	638	478
Research equipment	402	94
Licenses, permits and registrations	283	57
Dues and subscriptions	320	20
Support services allocation	41,562	38,043
Building supplies	145	-
Meetings	385	-
Machinery and equipment	484	-
Animal care	25	-
Registration fees	175	-
Depreciation	1,708	1,708
Total expenses	<u>257,687</u>	<u>243,291</u>
Excess of revenues over expenses	<u>\$ 14,131</u>	<u>\$ 3,627</u>
Surplus, beginning of year	\$ 110,714	\$ 107,087
Funds added (released into operations)	14,131	3,627
Surplus, end of year	<u>\$ 124,845</u>	<u>\$ 110,714</u>

These schedules should be read in conjunction with the accompanying consolidated financial statements and notes thereto.

NATIONAL AUDUBON SOCIETY, INC.
Research Ranch
Schedules of Changes in Research Ranch Fund
For the years ended June 30, 2016 and 2015

	<u>2016</u>	<u>2015</u>
ADDITIONS		
Interest and dividend income	\$ 95,909	\$ 111,891
Realized gains	43,360	414,633
Unrealized losses	<u>(305,247)</u>	<u>(444,434)</u>
Total additions	<u>(165,978)</u>	<u>82,090</u>
DEDUCTIONS		
Spending rule withdrawals	199,876	200,381
Investment fees and expenses	<u>9,295</u>	<u>13,933</u>
Total deductions	<u>209,171</u>	<u>214,314</u>
Net decrease in investments	(375,149)	(132,224)
Investments, beginning of year	<u>4,706,678</u>	<u>4,838,902</u>
Investments, end of year	<u>\$ 4,331,529</u>	<u>\$ 4,706,678</u>

These schedules should be read in conjunction with the accompanying consolidated financial statements and notes thereto.