



APPLETON-WHITTELL RESEARCH RANCH
of the
NATIONAL AUDUBON SOCIETY



ANNUAL REPORT - 2017

The Research Ranch is a collaborative effort among Audubon, Bureau of Land Management, Swift Current Land & Cattle Company, The Nature Conservancy, The Research Ranch Foundation, and U.S. Forest Service. The 8,000-acre sanctuary for native biota and ecological research facility is located in southeastern Arizona.

MISSION of the RESEARCH RANCH: To be a living laboratory to determine and demonstrate methods to safeguard and rehabilitate grasslands and related ecosystems, and to assist policy makers and other citizens in the care and protection of our native ecosystems, natural resources, and quality of life.

GOALS

- Conservation— to be a premier semi-arid grassland ecosystem that fosters a natural diversity of native species.
- Research – to understand how grasslands and related ecosystems function, and to recognize the key elements that safeguard these ecosystems.
- Outreach and Education— to advocate for grassland ecosystems by encouraging citizens and policy makers to safeguard and rehabilitate native ecosystems throughout the region.

From the Director

This is a bittersweet effort for me—this is the last annual report for AWRR that I compile; I am retiring in January after more than 18 years at AWRR. It has been an honor to be an Audubon employee and part of the Research Ranch team. I've been privileged to work with some of the finest conservationists and scientists imaginable.

The vision of Frank and Ariel Appleton (founders of the Research Ranch) lives on:

“To leave the land better than we found it.”

~Linda Kennedy, Ph.D., Director

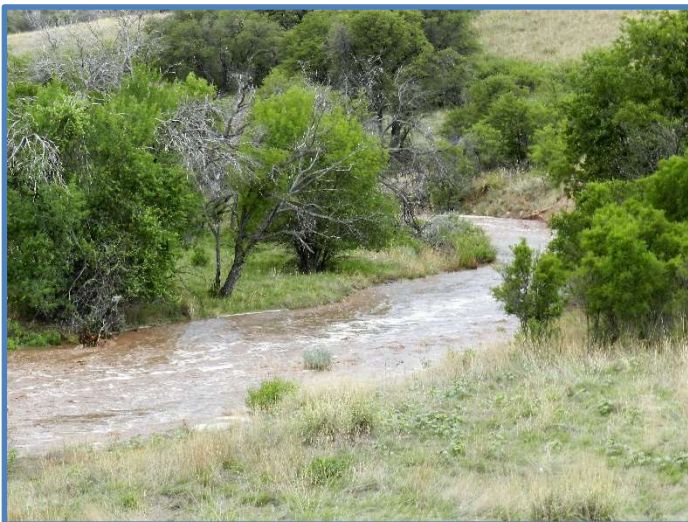
Mark Foreman, Conservation Program Manager
Linda Kennedy, Ph.D. Director
Suzanne Wilcox, Office Manager

Appleton-Whittell Research Ranch of the National Audubon Society
366 Research Ranch Road
Elgin, AZ 85611
<http://researchranch.audubon.org> & <http://az.audubon.org>
Researchranch@audubon.org
520 455 5522

CONSERVATION

PRECIPITATION: 2017 was bleak. Both winter precipitation and monsoon totals were below average. July was the only bright spot, but after the first week in August someone turned off the tap. Less than 1" fell between Aug 7 and the end of November. Months with below average precipitation are noted in red (see chart below). Unseasonably warm temperatures added to plant stress; there were few fall flowers and many perennial grasses have reduced seed set. This does not bode well for animals (birds, rodents) that rely on seed for the winter. We are already seeing fewer grassland sparrows than typical for this time of year.

Precipitation at Research Ranch Headquarters (inches)															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Cool Season Oct-Mar	Warm Season 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
2017	1.31	0.29	0.12	0.14	0.14	0.46	6.17	2.06	0.18	0.02	0.21	0.65	11.75	4.09	9.15
Mean	1.08	0.64	0.47	0.31	0.15	0.68	4.25	3.54	2.13	1.04	0.45	0.83	15.58	5.44	11.17



Although August and September rains were a disappointment, the rains in July created flow in several waterways, filling many tanks for the first time in several years.

Thanks to a donation from Phil Williams, we installed a weather station near headquarters that archives data on site and shares conditions at <https://www.wunderground.com/weather/us/az/fort-huachuca/KAZELGIN17> . Keegan Chapman and Tony Leonardini (volunteers) installed the equipment.



FIRE: Only one fire was reported on the Research Ranch in 2017. On July 17, lightning ignited this fire on East Mesa, which burned about 90 acres. The Sonoita-Elgin Fire District responded, as did a rainstorm. (Photo by Keegan Chapman.)

WATER FOR WILDLIFE: With financial support from US Fish & Wildlife Partners Program, advice and assistance from AZGF, volunteers from Sky Island Alliance, Borderland Restoration's BECY team, our own volunteer crew, and willing hands from USFWS, three professionally designed wetlands were shaped, lined, landscaped, and receive water via two new solar systems, also funded through a Partners grant.



INVASIVE SPECIES: Work continues on uplands invaded by non-native grasses and in sacaton grasslands infested with whitetop. One grant from Arizona Forestry and Fire Management (PTG 14-901) was completed in September and another grant for Phase 3 to maintain and expand the project area was awarded (PTG-14-905). Monitoring has shown that uplands with up to 70% frequency of Lehmann lovegrass can be reclaimed. In Phase 3 we will address an area with 90% frequency of Lehmann lovegrass, and maintain the areas treated in the first two phases of this project.

RESEARCH & MONITORING

2017 Apacheria Fellows



Thanks to generous financial support from the friends of the Research Ranch, we were able to award four Apacheria Fellowships in 2017!

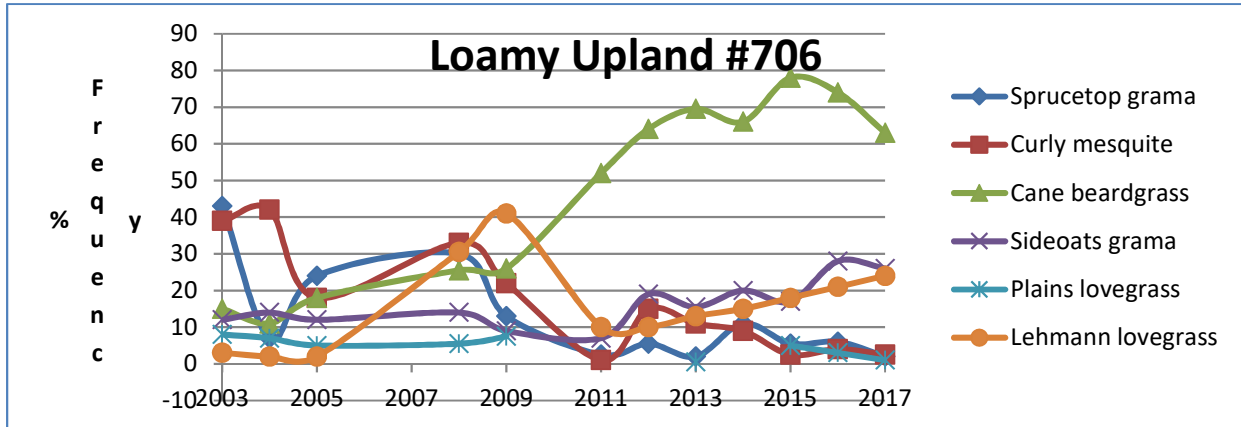
Left to right: **Dawson Brown** is a junior at Christopher Newport University, Newport News, VA. Dawson is studying aggressiveness and social dominance in long-tailed brush lizards (*Urosaurus graciosus*).

Caylee Falvo is a graduate student at Colorado State University, Ft. Collins, CO. She is using her Apacheria/Fleharty fellowship to determine the impact of climate change on the Uinta ground squirrel (*Urocitellus armatus*). **Anthony Gilbert**, Ph.D. Candidate at Ohio University, is no stranger to our Honors Wall. This is the third year his work on the thermal dependence on locomotor performance of Ornate Tree Lizards (*Urosaurus ornatus*) has earned an Apacheria Fellowship. **Cheyenne Hertzog** is an undergraduate at Arizona State University. Her fellowship supports Cheyenne's study to determine the abundance of meso-mammals in different forest types of the San Pedro and Gila Rivers.



CHRISTMAS BIRD COUNT: The 2016 AWCBC was held on Jan 3, 2017 and preliminary results tallied 103 species, down from 105 from the 2015 count, and 4448 individuals, up from 2726 in 2015. A Golden-crowned Sparrow was the most unusual sighting. Suzanne Wilcox, AWRR Office Manager, and Tony Leonardini, AWRR volunteer, organized the event and compiled the results. Emily Martell (at left), Teacher/Naturalist, Audubon Arizona.

UPLAND VEGETATION MONITORING: All transects were completed as scheduled. The saga of #706 continues with Cane Beardgrass still dominant but trending downward. Lehmann Lovegrass is trending upward but still well below the high point reached in 2009. This is the only untreated transect in which we have documented native plants (i.e. Cane Beardgrass and Sideoats) increasing in an area once dominated by Lehmann's.



Matthew Lattanzio, Ph.D., Christopher Newport U.
Research annual report for summer 2017

This past summer at the ranch I continued my ongoing work at the ranch and nearby field sites. My work continues to focus on evolutionary ecology of lizards. I continued collecting data on the responses of tree lizards to varying burn histories at the ranch itself; my current goal is to compile data from 2010-2017 into a single publication, along with data from lizards sampled throughout Arizona. The focus of this publication will be on the factors contributing to changes in the color polymorphism (in terms of frequencies of each morph) in this species over time. Our understanding of these patterns and the role of other factors in driving them, remains limited. In future summers (2018), my goal is to still collect lizards from those established ranch sites, but focus on addressing other research questions. Currently, I am analyzing data for this bigger project and preparing a paper for publication.



I also continued my work on species from off the ranch as well, including a continued ecological study on Yarrow's spiny lizards in the Huachuca Mountains and a study on the long-tailed brush lizard that I began last summer (2016). For the first project, I plan to compile a few more field seasons' of data before considering it ready for publication. For the latter project, I had a student (Dawson) take lead on a behavioral study exploring the social dominance hierarchy in that species, which was unknown at the time. Although I also collected my typical physiological and ecological data on the species, the student's project took center stage overall. Our collaboration has been highly productive, and I am happy to report that we have submitted a draft of a manuscript of his research to the peer-reviewed journal *Behavioral Ecology*!

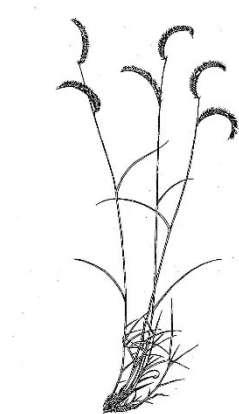
Another exciting project was undertaken in 2017 – **a bat survey!** The rehabilitation of wetlands at McDaniel and Finley provided the opportunity to collect data pre-treatment to evaluate the effectiveness of these projects to provide habitat for bats. Sky Island Alliance provided funding for the preliminary data collection undertaken by Bat Survey Solutions, LLC. Janet Tyburek (right) is attaching a mist net, one of the techniques used.



Among bats captured and released was this California myotis.

Photo credit: J.D. Chengler / www.batmanagment.com

To see a complete list of active research/ monitoring projects and publications associated with the Research Ranch, see pages 13-14.



EDUCATION & OUTREACH

Field Trips, classes, trainings, and meetings are opportunities to share AWRR's mission with a broad audience. Activities at AWRR in 2017 included:

Natural Resource
Management Field Techniques
Class
New Mexico State University
Dr. Pedro Chavarria, Instructor
(in green)



Soils Training
Robinett Rangeland Resources, LLC



Joint Field Trip:
Department of Arizona Forestry
& Fire Management
US Forest Service



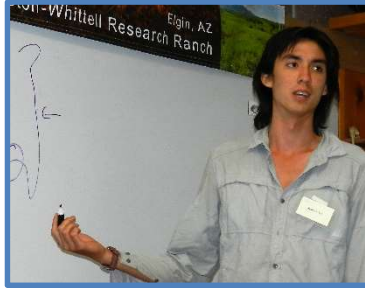
Sentinel Landscape Restoration
Partnership (left)

Chiricahua Leopard Frog, Unit 2
Recovery Team (below)



Living Gently on the Land

We added something new to our **Living Gently on the Land** (aka Potlucks & Presentations) educational seminar series. We usually take a break through the summer, but this July we asked the resident researchers and interns to share their projects (the photos below are of some of the presenters).



Clockwise from above, left: Sean Carter (former Apacheria Fellow), Grace Igwe (NMSU), Shericia Campbell (Virginia State), and Christian H. d'Orgeix (Blacksburg High School)

Our regular events featured:

- "Black Footed Ferrets,"** by Holly Hicks, Arizona Game & Fish
- "Gray Hawk Study,"** by Ariana LaPorte, University of Arizona
- "Yellow Billed Cuckoos,"** by Dr. Tony Leonardini, AWRR Volunteer
- "Coronado National Forest,"** by Daisy Kinsey, SV District Ranger
- "Evolution of Hummingbird Visual Signals,"** by Rick Simpson, Arizona State University
- "Vaquita Porpoises,"** by Greg Joder
- "A Pictorial Trip through Africa of the 1960s,"** by Chuck Hansen,
- "Introduction to Field Research Stations"** by Mary Price, Mark Stromberg, Kim Franklin, Nick Waser, Michele Lanan, Ben Wilder (Rocky Mountain Biological Laboratory, Hastings Natural History Museum, Arizona-Sonora Desert Museum, Rocky Mountain Biological Laboratory, Southwest Research Station, Tumamoc Hill Desert Laboratory, respectively).



The **Science on the Sonoita Plain Symposium**, an outgrowth of the Sonoita Valley Planning Partnership, was held at AWRR on June 3rd, the 9th year that scientists, land managers, and other interested parties have gathered to share information, updates and concerns. This year the focus of the morning's presentations was how science is used to guide land management decisions. The afternoon included a session on "Water and Landscape" plus a "Grab-bag" session.



The Proceedings of the 2017 Science on the Sonoita Plain is available at:
<http://researchranch.audubon.org/library>

ADMINISTRATION

PERSONNEL

Bill Piper passed away in 2017, and although he was never an Audubon employee, his influence on what has become the Research Ranch is too important not to memorialize. The Appletons hired Mr. Piper as manager of their Elgin Hereford Cattle Ranch in the 1950s & 1960s. He and the Appletons followed the "Leave the land better than you found it" policy of management, which included installation of multiple erosion control features, a reliance on sound range management principles, and encouragement of research. (photo courtesy of Terry Piper)



Mark Foreman, AWRR's new Conservation Program Manager, arrived just in time for monitoring season! Mark, a Tucson native, holds a M.S. in Range and Wildlife Management from Sul Ross University and came to us from New Mexico, where he was a Range Management Specialist with USDA NRCS. Mark replaced Roger Cogan, who retired in July after almost 7 years with Audubon.

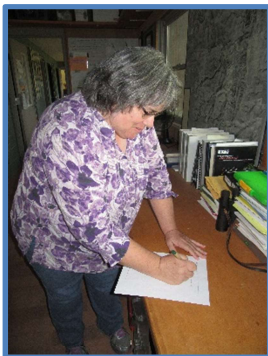
FACILITIES: The Casita (AKA Robinson Cottage) now has a new roof. No. More. Leaks!



FIREWISE DAY! Volunteers helped protect facilities from damage by wildfire by trimming shrubs near buildings and creating fire resistant space around the

well that serves the Research complex (photo, above). This well is especially at risk during wildfire as it is surrounded by sacaton. Flame lengths of sacaton can reach 40 ft.

COLLABORATION is a big part of advancing the mission of the Research Ranch, and 2017 brought the opportunity for a new effort that has great potential. It's still in the very preliminary planning stages, but if enthusiasm will make it become reality then it's only a matter of time before this becomes an established network of ecological field research stations/institutions with a regional focus. The initial meeting at AWRR included individuals with experience at the University of Arizona's Tumamoc Hill/Desert Laboratory, Arizona-Sonora Desert Museum, American Museum of Natural History's Southwest Research Center, University of California's Field Research Stations, and Rocky Mountain Biological Laboratory. Among the issues to be addressed in future meetings will be opportunities to collaborate (research, facilities, equipment, PR, workshops, classes), mechanisms by which to capitalize on this collaboration, expansion of group size, and a name for *this ad hoc* group.



COORDINATED RESOURCE MANAGEMENT PLAN for AWRR

Karen Simms, Acting Field Manager of the Tucson office at BLM, signed the CRMP prepared by the USDA-NRCS for the Research Ranch. This plan and other information about the Research Ranch can be found at:

<http://researchranch.audubon.org/landing/library/reports-associated-awrr>

DISTRIBUTIONS from the Research Ranch endowment for FY16/17 totaled \$205,212. The market value of the endowment fund on July 1, 2017 equaled \$4,833,074, which is very close to its value on July 1, 2014.

NATIONAL AUDUBON SOCIETY, INC.

Research Ranch

Schedules of Activities - Research Ranch and Changes in Surplus Fund

For the years ended June 30, 2017 and 2016

	2017	2016
REVENUE		
Contributions	\$ 32,470	\$ 10,845
Bequests	-	10,226
Grants	12,361	7,771
Sales	-	75
Rentals	8,293	8,820
Pooled investment income - appropriated	205,212	199,876
Other income	31,000	21,630
Assets released from restrictions	-	12,575
Total revenue	<u>289,336</u>	<u>271,818</u>
EXPENSES		
Salaries and fringe benefits	188,816	173,740
Travel	16	103
Professional and consulting fees	706	855
Postage - general	219	81
Gas and electricity	1,585	1,969
Building and office maintenance	883	13,801
Telephone	7,034	4,830
Insurance	6,857	6,352
Maintenance - general, road and vehicles	12,660	2,046
Office and household supplies	2,569	2,846
Scholarships	1,875	1,250
Equipment rental	59	108
Furniture and fixtures	717	1,603
Computer equipment and software	666	607
Farm supplies	28	1,369
Printing	6,830	638
Research equipment	1,330	402
Licenses, permits and registrations	660	283
Dues and subscriptions	150	320
Support services allocation	46,063	41,562
Building supplies	1,496	145
Meetings	154	385
Machinery and equipment	6,808	484
Animal care	12	25
Registration fees	-	175
Refuse and Recycling	712	-
Education Materials	32	-
Depreciation	52	1,708
Total expenses	<u>288,989</u>	<u>257,687</u>
Excess of revenues over expenses	<u>\$ 347</u>	<u>\$ 14,131</u>
Surplus, beginning of year	\$ 124,845	\$ 110,714
Funds added (released into operations)	<u>347</u>	<u>14,131</u>
Surplus, end of year	<u>\$ 125,192</u>	<u>\$ 124,845</u>

Science on Appleton-Whittell Research Ranch

Active Research/Monitoring Projects – 2017

Active: 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

AmeriFlux Network Tech Team (ameriflux.lbl.gov), Lawrence Berkeley National Laboratory, Berkeley, CA; 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

Anderson, Erik and Dr. Robert Steidl. SNRE, University of Arizona.

Subject: Sites on Research Ranch to be used as control/reference compared to grazed grasslands

Applicability: Better understanding of ecological processes driving grassland ecosystems and aid development of sound management practices.

Chiricahua Leopard Frog Reintroductions and Surveys

Arizona Game & Fish Dept. (AZGF): Tom Jones, Audrey Owens & Hunter McCall

Subject: Survey leopard frog reintroduction efforts

Application: Protect native, federally listed species

Desert Pupfish

Arizona Game & Fish Dept. (AZGF): Ross Timmons.

Subject: Monitor and protect population of pupfish introduced into ranch stockponds and wildlife waters

Application: Conserve native species

Fish Surveys

Arizona Game and Fish Department (AZGF). Fisheries biologists

Subject: Conduct periodic surveys of the riparian systems of the Research Ranch and neighboring properties

Application: Evaluate stability of populations of native species, recommend management actions

Gould's Turkeys near Huachuca Mountains

Arizona Game & Fish Dept. (AZGF) Brittany Oleson (2016) Sonoita, AZ

Project: Estimate populations

Application: Track success of re-introduction effort

Northern Mexican Gartersnake Management

Arizona Game & Fish Dept. (AZGF) Tom Jones, Mason Ryan (2017). Linda Kennedy, Volunteer, covered under AZGF Section 6 authority.

Subject: Observe Mexican Gartersnakes

Application: Manage federally threatened species.

Pronghorn Survey

Arizona Game & Fish Dept (AZGF): Brad Fulk (2016); Audubon staff on AWRR

Project: Ground survey of Pronghorn on AWRR

Application: Data pooled with other surveys in area to estimate population size

Arizona Tree Frog documentation

Audubon Staff

Project: Document all sightings.

Application: Species was candidate for federal listing (declined) 2017. Continue to document sightings

Avian Monitoring for Research Ranch IBA

Audubon staff: Tice Supplee, Tony Leonardini (Vol)
Project: Monitor bird species on AWRR
Application: Support IBA nomination (see also Wonkka), examine longterm trends

Bullfrogs, Monitoring and Treatment on the Research Ranch

Audubon Staff: Linda Kennedy, Mark Foreman, Suzanne Wilcox, Tony Leonardini (Vol).
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 (Office Manager) & Tony Leonardini (Volunteer) Co-compilers since 2015
Subject: Conduct bird count as per Audubon standards.

Depth to groundwater on Research Ranch

Audubon Staff & Volunteers
Project: Monitor the depth to groundwater of the wells on Research Ranch.
Application: This study helps establish a water consumption baseline for the Sonoita Valley.

Ecological Site Monitoring (ESM)/ aka Upland Vegetation Monitoring

Audubon Staff– Linda Kennedy
Project: Establish permanent points to monitor vegetation change. Based on Ecological Site Map (Robinett & Breckenfeld)
Application: Identify trends in vegetation change

Effects of fire and climate change on cacti

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

Effects of fire and climate change on mesquite

Audubon Staff: Linda Kennedy
Project: Monitor the effects of fire and climate change on mesquite.
Application: Baseline information for future research and identify trends

Geographic Information System

Audubon Staff – Suzanne Wilcox, Mark Foreman (see also: Geiger, Loomis, Seltzer)
Project: Map research, monitoring, conservation sites.
Application: Archival, management.

Gould's Turkeys on the Research Ranch

Audubon Staff: Linda Kennedy, Suzanne Wilcox, Mark Foreman, Tony Leonardini (Vol)
Project: Record sightings of wild turkeys.
Application: Document spread of sub-species reintroduced in Huachuca Mtns.

Herbarium of the Appleton-Whittell Research Ranch

Audubon Staff
Project: Archive voucher specimens of plant species
Application: Baseline information. Reference. Research Support

Monarch Sightings

Audubon Staff: Linda Kennedy
Project: Report sighting of Monarchs to Gail Morris (Southwest Monarch Study)
Application: Advance knowledge of phenology, food sources of species.

Precipitation at Ecological Sites

Audubon Staff – Linda Kennedy, Suzanne Wilcox

Project: Establish range gages to correspond with ESM. Based on Ecological Site Map (Robinett & Breckenfeld)

Application: Correlate precipitation with changes in vegetation.

Sacaton Rehabilitation

Audubon staff: Linda Kennedy

Project: Re-establish *Sporobolus wrightii* in appropriate degraded sites.

Application: Improve wildlife habitat, bioremediation of sites dominated by exotic, invasive Bermudagrass.

Small mammal populations on the Appleton-Whittell Research Ranch

Audubon Staff: Linda Kennedy

Project: Develop long-term monitoring program based on Jones, Bock and Kennedy

Application: Indicate trends in small mammal populations

Yellow-billed Cuckoo Surveys

Audubon Staff: Steve Prager (Audubon AZ), Tony Leonardini (volunteer). See also Kraft & Leonardini

Project: Search for this federally threatened species using USFWS protocol

Application: Document presence and habitat use on AWRR

Invasive Green Sunfish

Audubon Staff

Project: Remove from tinijas in South Post Canyon

Application: Create habitat for native biota

Biodiversity of the Research Ranch

Audubon Staff/Volunteers (Virginia Dean, also Christina Francois)

Project: Accumulate data/records from publications

Application: Arrive at baseline of known biota

Precipitation at AWRR Headquarters (Physical gage)

Audubon Staff

Project: Determine precipitation received in 24 hrs prior to 7 a.m., daily

Application: Calibrate electronic gages. Enter into rainlog

Survivorship of Riparian Trees in the Southwest

Bock, Carl & Jane Bock. University of Colorado (retired)

Project: Resurvey the riparian trees tagged in the 1980s.

Application: Determine the survivorship of native trees after fires, flood and drought

Effect of Throat Color and Relative Resource Strength on Social Dominance in the Long-tailed Brush Lizard (*Urosaurus* *graciosus*)

Brown, Dawson and Matthew Lattanzio. Christopher Newport University, Newport News, VA 23606

Project: Determine relationship between throat color and social dominance and determine if social dominance is fixed or variable depending on environmental conditions.

Application: Contribute to limited information about natural history of this species.

Agave Monitoring

Bureau of Land Management (BLM) Tucson Field office and University of Arizona (Cochise Co. Extension). Kristen Duarte (BLM), Kim McReynolds (U of A)

Project: Establish permanent transects to monitor agave numbers, class and herbivory.

Application: Ungrazed land to function as control.

Assessing condition of O'Donnell Creek

Bureau of Land Management (BLM). Simms, Jeffrey, Fish Biologist, Tucson Field Office, Nate Dietrich, Hydrologist.

Project: Use Proper Functioning Condition Standards to evaluate a portion of O'Donnell Creek

Application: Environmental Assessment

Population dynamics and habitat characteristics of Montezuma (Mearn's) Quail in southeastern Arizona

Chavarria, Pedro Mazier, Ph.D., New Mexico State University

Subject: Monitoring movement of quail.

Application: Fill knowledge gaps about life history and determine how behavior and genetic viability are affected in areas where hunting is, and is not, allowed.

Annotated Bibliography of Lehmann Lovegrass

Chasey, Richard Adam. San Francisco State University

Project: Gather all known publications associated with non-native, invasive *Eragrostis Lehmanniana*

Application: Aid to research and management

Survey of herpetofauna (reptiles and amphibians) including den sites of Crotalids on the Research Ranch

Cogan, Roger C.

Project: Document sightings of herps and monitor winter den sites

Application: Determine whether new 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

Cogan, Roger C.

Project: Distribute coverboards in specific locations across AWRR

Application: Evaluate technique to further baseline knowledge about reptiles on AWRR

A History of the Lands in the National Audubon Society's Research Ranch Near Elgin, in Santa Cruz County, Arizona

Collins, Glendon E., Bureau of Land Management (retired), Arizona State Trust Lands (retired). Phoenix.

Subject: Compile and document history of land transactions involving federal and state lands.

Application: Background

Seeds of Success

Desert Botanical Garden. Steve Blackwell, 1201 N Galvin Parkway, Phoenix

Subject: Collect specific native seeds on behalf of BLM program.

Applicability: To be used to augment collections of native, site adapted seed.

Current Distribution and Status of Slevin's Bunchgrass Lizard, *Sceloporus slevini*, in southeastern Arizona

d'Orgeix, Christian, Ph.D.; Virginia State University; Petersburg, VA: see also Nakiesha D. Bridgers.

Project: Survey for bunchgrass lizard. Collect tissue for DNA analysis (tip of tail – no take) 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

d'Orgeix, Christian, 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 species of special concern (AZGF)

Optimal Foraging in Harvester Ants

D'Orgeix, Christian H.; Blacksburg High School, Blacksburg, VA.

Project: Examine the role of seed size in foraging behavior

Application: Results will assist in determining the ecological role of ants in the environment

Annotated bibliography of selected reports, publications and theses

Dyson Ruth E.

Project: Prepare annotated list/bibliography of publications of particular interest to ARR.

Application: Facilitate information exchange and document publications

Coping with Winter Climate Change: Physiological Mechanisms & Demographic Outcomes

Falvo, Caylee. Utah State University, Department of Wildland Resources and the Ecology Center. Logan UT
Project: Determine the impact of climate change on the phenology, demography, and fitness of the Uinta ground squirrel (*Urocitellus armatus*).
Application: Add to our understanding of winter climate change impacts on hibernators.

Genetic approach for using pollen to determine plant resources used by nectarivorous bats.

Ferguson, George, University of Arizona, Tucson Arizona
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

Fernald, Alexander G. (Sam), Ph.D., NMSU. Las Cruces, NM . 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*

Fishbein, Mark, 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

Forrestel, Elisabeth, Melinda Smith, Ph.D., Yale University.
Project: Compare natural grasslands across broad precipitation gradients in North America, Australia, South Africa.
Application: Provide evolutionary history and functional biology of ecologically and economically important grass species here.

Ecological and evolutionary responses of lizards to resource limitation

Gilbert, Anthony. 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

Thermal sensitivity of insensitivity of dominance behavior

Goerge, Tyler, Ohio University.
Project: Compare laboratory-determined thermal sensitivities of push up displays in *Urosaurus ornatus* to those observed in the field.
Application: Insight into impacts of climate change on lizard social dynamics

Research Ranch boundary surveying and mapping

Greene, Dale 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

Grissell, Eric, Sonoita, AZ
Project: Study insect diversity in southwest
Application: Significant contribution to state of knowledge

Monitoring wildlife in and near the Appleton-Whittell Research Ranch using trail cameras

Hass, C.C.
Project: Use trail cameras to identify and monitor various species of terrestrial wildlife.
Application: Identify habitat specific wildlife use and develop index for long-term trends.

Effects of Invasive *Tamarix* on Mammal Communities in Riparian Forests

Herzog, Cheyenne. Arizona State University, Polytechnic

Project: Measure abundance of meso-mammals across 3 riparian forest types.

Application: Provide sound science to support research decisions concerning saltcedar and habitats

Prey Abundance Survey for the Installation of Burrowing Owl Burrows

Igwe, Grace. New Mexico State University

Project: Compare arthropod abundance among native grasslands and grasslands dominated by Lehmann and Boer lovegrasses.

Application: Aid in decision making process for establishment of artificial burrows

Linking individual behavior, microhabitat use, and spatial population structure with fitness

Jaworski, Kortney. 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.

Camera-trap Network

Joder, Greg., Tucson, AZ

Project: Collect photographic or video for archival purposes.

Application: Augmentation of research, ecosystem conservation and education/outreach goals of AWRR.

Photo-herbarium for the Research Ranch

Kennedy Linda, Director, Research Ranch

Project: Document life stages of plant species found on the Research Ranch.

Application: Baseline information for future research; Aids identification.

Passive surveys of Yellow-billed Cuckoos

Kraft, John, Coronado National Forest, and Tony Leonardini,

Project: Place bioacoustic recorders along established avian transects

Application: Determine if passive survey techniques effectively monitor this federally listed (Threatened) species

Oak (*Quercus*) water use strategies in Sky Island Systems

Lackey, Russell; Texas Tech University, Lubbock, TX

Project: Determine physiological drought tolerance of native oak species

Application: Explain current patterns in community composition and distribution in relation to water balance.

Modeling impacts of habitat alterations on habitat use and diet selection of desert reptile communities

Lattanzio, Matthew S., 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

How Duration of Occupancy Influences Lehmann Lovegrass Invasion Success: a Temporal Analysis of Plant-soil Feedbacks

Lehnhoff, Erik A., Ph.D. and Sherri L. Buerdsell. New Mexico State University, Las Cruces, NM

Project: Evaluate effect of Lehmann lovegrass invasion on black grama.

Application: Add to understanding the mechanisms of invasions in rangeland ecosystems and assist in management decisions for Lehmann lovegrass control

Avian Survey/Monitoring of the Research Ranch

Leonardini, Tony. Ph.D., Sonoita, AZ

Project: Document avian species composition and population size.

Application: Baseline information and trends. Develop database to track and archive data.

Flora of the Appleton-Whittell Research Ranch

McLaughlin Steven P., Ph.D., University of Arizona, (Ret.), Erika L. Geiger; University of Arizona; Janice E. Bowers; U.S. Geological Survey (Ret)

Project: Compile a flora –a complete list of all flowering plants, ferns, and conifers on the Research Ranch.

Application: Baseline for ongoing and future research

Flora of Upper O'Donnell Canyon

Miller, Kathryn. 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. Information available via SEINET

Factors affecting variation in the escape behavior of *Urosaurus ornatus*

Morris, Cynthia. 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

Nichols, Clay. Eastern New Mexico University, Portales, New Mexico 88130.

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; John Hughes, NOAA, National Data Climatic Center, U.S. Climate Reference Network, Ashville, 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

O'Neal, Kelley. University of Maryland, College Park, MD 20742.

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

Pulliam, H. Ron. Borderlands Restoration, L3C. Patagonia AZ 85624

Subject: Re-establish avian plots from 1970s & 1980s to serve as control/reference areas.

Applicability: Evaluate effectiveness of rehabilitation efforts on Babacomari Cattle Ranch.

Species boundaries and phylogeography of the dwarf milkweed group

Riser, James P.II. School of Biological Sciences, Washington State University.

Project: Collect leaf tissue from *Asclepias uncialis* for DNA analysis

Application: Determine species boundaries and taxonomic status

Babocomari River Protection

Robinett, Daniel G., Robinett Rangeland Resources, Catalina, AZ; Donna Mathews, Coronado RD & D., Inc. Willcox, AZ.

Project: Establish transects and monitor streamside conditions of Babocomari River, O'Donnell and Turkey Creek

Application: Results will enable sound management decisions to maintain and/or improve vegetation conditions on Babocomari watershed. Will have application to other desert rivers.

Ornate Box Turtles in Arizona: Status, Ecology, and Conservation Study Methods

Rosen, Phil and David Hall. University of Arizona

Project: Conduct field surveys to determine current distribution, population status, and management needs of the Ornate Box Turtle.

Application: Evaluate trends and conservation status of Ornate Box Turtle

Effects of the Ryan Wildfire (April 2002) on Wintering Grassland Birds in the Sonoita Valley, Arizona

Ruth, Janet M. Ph.D., USGS Arid Lands Field Station, (retired)

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

Ruth, Janet M. Ph.D., USGS Arid Lands Field Station, (retired)

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 savannarum ammodramus*), and associated priority grassland species, throughout its known range in the Southwest U.S.

Ruth, Janet M. Ph.D., USGS Arid Lands Field Station, (retired)

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

Salywon, Andrew, Ph.D., and R.J. Tiller, Ph.D., Desert Botanical Garden, Phoenix, AZ

Project: Install pressure transducers in wells and piezometers to expand research program begun on northern portion of Las Cienegas NCA.

Application: Enhance ability to record temperature and water depth and data sharing capability.

Evolution of Hummingbird Visual Traits

Simpson, Richard (Rick). Arizona State University, Tempe, AZ

Project: Film male hummingbird courtship displays and measure plumage coloration

Application: Understand the mechanisms by which multiple ornaments evolved

Population and habitat assessment of *Spiranthes delitescens*

Stromberg, Juliet, Ph.D., and Dustin Wolkis. Arizona State University, Tempe, AZ. Kimberlie McCue, Ph.D., and Steve Blackwell, Desert Botanical Garden

Project: Survey for and assess population size of *Spiranthes delitescens* (Canelo hills ladies tresses) and the wetland habitat.

Application: Information necessary for development of recovery plan for federally Endangered species.

Huachuca Water Umbel seed bank study

Stromberg, Juliet. 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

Compilation of Weather Data from the Sonoita Plain

Stromberg, Mark. Hastings Museum of Natural History, Berkeley (Retired)

Project: Develop archive of climate/weather data from grasslands of the Sonoita Plain

Application: Available to researchers and lay public interested in source of surface and ground water

Wet-Dry Mapping

The Nature Conservancy. Miller, J.B. (resigned, 2016), Canelo Hills Cienega Preserve

Project: Map extent of open water in O'Donnell Canyon

Application: Track health of the San Pedro river.

Factors Driving Trophic Niche Variation in a Widespread Lizard

Ternes, William (Will). 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

Research and reintroduction effort for Huachuca Water Umbel

Titus Jonathan H., Ph.D., SUNY-Fredonia, Fredonia, NY; Priscilla Titus, Fredonia NY

Key words: *Lillaeopsis schaffneriana* ssp. *recurva*., listed species, recovery plan

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: Will document species' response to climate change on large scale

Audubon Research Ranch/Sky Island Alliance Bat Survey 2017

Tyburec, Janet. Bat Survey Solutions, LLC. Tucson, AZ

Project: Perform pre-construction surveys of bat populations and Finley and McDaniel

Application: Baseline information that can be used to determine effectiveness of wetland construction

Conservation Effects Assessment Project on the Cienega Creek Watershed

USDA-ARS, Southwest Watershed Research Center, Goodrich, David C. and Haiyan Wei.

Project: Research Ranch as a control to judge vegetation cover and condition for a non-grazed condition

Application: Quantify the benefits of conservation management and practices.

Meteorological Station

USDA-ARS; Southwest Watershed Research Center.

Project: Station jointly owned by ARR & USDA

Application: Baseline information on climate available to researchers and land managers of region

Walnut Gulch Experimental Watershed Herbarium

USDA-ARS Southwest Watershed Research Center, Phil Heilman, Ph.D., Research Leader & Linda Kennedy, AWRR.

Project: Prepare digital record of existing herbarium vouchers, updated per USDA Plants Database.

Application: Baseline vegetation information available in digital format.

Inventory of ecological sites, their present day condition, trend and rangeland health on the Research Ranch

USDA. –N.R.C.S. Robinett Dan, Don Breckenfeld, (Both Retired) Tucson, AZ

Project: Mapped the ecological sites on ARR and compared present day plant communities to what our 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 on the Research Ranch

USDA-NRCS Breckenfeld, Donald J., 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 Dial, Heather. 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. Boness, Patricia (field lead), David Watson (soil scientist), Wayne Robbie (Albuquerque Regional Field Office)

Project: Mapping of 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

Agave Monitoring on the Coronado National Forest

USFS Biedenbender, Sharon, Ph.D. (retired)

Project: Monitor impacts of livestock grazing on florivory of agave

Application: Management of food source for lesser long-nosed bat

***Pectis imberbis* surveys**

USFWS. Julie Crawford. Tucson, AZ.

Project: Survey reported sites

Application: Information on species that may become federally listed.

Inventory of native plant-feeding insects Arizona

Wheeler, Alfred G., 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

20 Year Dynamics of North American Ant Communities: Evaluating the Role of Climate and Biogeochemistry on Ecological Change

Weiser, Michael D., University of Oklahoma, Dept of Biology, Norman OK.

Project: Resampling ants from transects established by Mike Kaspari's group in 1980's

Application: Measure changes in abundance, diversity and composition

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

Wright, Corynne A., Christopher Newport University, Newport News. Virginia

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)

Zweck, Justin. 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.

**Reports and Publications Associated with the Research Ranch
Received since 2017 Annual Report**

Biederman, J.A., Scott, R.L., Bell, T.W., Bowling, D.R., Dore, S., Garatuza-Payan, J., Kolb, T.E., Krishnan, P., Krofcheck, D.J., Litvak, M.E., Mauer, G.E., Meyers, T.P., Oechel, W.C., Papuga, S.A., Ponce-Campos, G.E., Rodriguez, J.C., Smith, W.K., Vargas, R., Watts, C.J., Yopez, E.A., Goulden, M.L. 2017. CO₂ exchange and evapotranspiration across dryland ecosystems of southwestern North America. *Global Change Biology* 2017;1018. DOI:10.1111/gcb.13686

Chavarria, Pedro M., Silvy, Nova J., Lopez, Roel R., Davis, Donald S., Montoya, Angel. 2017. Ranges and Movements of Montezuma Quail in Southeast Arizona. *National Quail Symposium Proceedings* 8:359-368.

Chavarria, Pedro M., Silvy, Nova J., Lopez, Roel R., Davis, Donald S., Montoya, Angel. 2017. Survival Demographics of Montezuma Quail in Southeast Arizona. *National Quail Symposium Proceedings* 8:369-274.

Duncan, Doug. 2017. Implementation of the Topminnow and Pupfish Safe Harbor Agreement at the Appleton-Whittell Research Ranch of Audubon. Presentation and Report. *Proceedings of the 2017 Science on the Sonoita Plain symposium*. Pgs 18,19. June 3, 2017. <http://researchranch.audubon.org/landing/library/science-sonoita-plain>

Gilbert, AL, Miles, DB. 2017. Natural Selection on Thermal Preference, Critical Thermal Maxima and Locomotor Performance. *Proc. R. Soc. B* 284: 20170536. <http://dx.doi.org/10.1098/rspt.2017.0536>.

Jaworski, Kortney & Lattanzio, Matthew S. 2017. Physiological Consequences of Food Limitation for a Color Polymorphic Lizard: Are Coping Responses Morph-Specific? *Copeia* 105 (4) 691-697.

Jaworski, Kortney & Lattanzio, Matthew S. 2017. Social and Ecological Consequences of Sexual Size Dimorphism in Mountain Spiny Lizard (*Sceloporus jarrovi*). Abstract & Poster. *Proceedings of the 2017 Science on the Sonoita Plain symposium*. Pg 40. June 3, 2017. <http://researchranch.audubon.org/landing/library/science-sonoita-plain>

Krishnan, Praveena; Meyers, Tilden; and Heuer, Mark W. 2017. Variability of soil CO₂ efflux in a semiarid grassland in Arizona. Poster presentation at *American Geophysical Union* fall meeting. New Orleans. Dec 15, 2017. B51G-1899.

McIntire, M., K. McReynolds. 2017. Agave Monitoring - Appleton-Whittell Research Ranch. Special Report prepared by University of Arizona Cooperative Extension for the Bureau of Land Management. 5 pages.

Ruth, J.M. 2017. Life history attributes of Arizona Grasshopper Sparrow (*Ammodramus savannarum ammodramus*) and Comparisons with Other North American Subspecies. *American Midland Naturalist* 178:64-81.

Ruth, J., Skagen, S.K. 2017. Territory and Nest Site Selection Patterns by Grasshopper Sparrows in Southeastern Arizona. *The Condor: Ornithological Applications* 119: 469-483.

Ruth, J.M., 2017. Roadside Survey Data from southeastern Arizona and New Mexico for Grasshopper Sparrow and other grassland Birds 2003 to 2005. *U.S. Geological Survey data release*. [HTTPS://doi.org/10.5066/F73777MK](https://doi.org/10.5066/F73777MK).

Simpson, Richard K. 2017. Courtship and Territorial Behaviors of Three Hummingbird Species in Arizona. *Arizona Birds*. Volume 2017. Pages 1-7

Simpson, R.K. & McGraw, K.J. 2017. The co-evolution of hummingbird coloration and courtship displays. Abstract and Presentation. *Animal Behavior Society Meeting*. Toronto, Canada. June 12-16.

Stromberg, Mark. 2017. Rain Stays Mostly on the Plain. Sonoita Reflections. 9 pgs. <http://sonoitareflections.blogspot.com/2017/06/rain-stays-mostly-on-plain.html>

Supplee, Tice; Prager, Steve; & Wise, Cathy. 2017. Ten Year Summary of Grassland Bird Point Counts at Appleton-Whittell Research Ranch. Special Report. 8 pages.

Supplee, Tice. 2017. Ten Year Summary of Grassland Bird Point Counts at Appleton-Whittell Research Ranch. Abstract & Poster. *Proceedings of the 2017 Science on the Sonoita Plain* symposium. Pgs 33, 34. June 3, 2017. <http://researchranch.audubon.org/landing/library/science-sonoita-plain>

Tyburek, Janet. 2017. Appleton-Whittell Audubon Research Ranch Bat Survey 2017. Special Report prepared for Sky Island Alliance and AWRR. Bat Survey Solutions, LLC. 2 pages

Wilcox, Suzanne. 2017. Compiler: Proceedings of 9th Annual Science on the Sonoita Plain Symposium. 41 pgs. <http://researchranch.audubon.org/landing/library/science-sonoita-plain>



Sunrise
December 5, 2017