

Appleton-Whittell Research Ranch of the National Audubon Society

2023 Annual Report



A living laboratory focused on research, conservation, and engagement, the Appleton-Whittell Research Ranch of the National Audubon Society facilitates the science and organizes the community needed to protect and enhance the grasslands of southeastern Arizona and beyond.

We are pleased to provide you with this report highlighting important accomplishments including:

- Stewarding 8,000 acres of grasslands, oak woodlands, and riparian corridors
- Implementing new and innovative programs that engage the public in hands-on conservation and relaunching classic Research Ranch programming not seen since before the Covid-19 pandemic
- Developing new partnerships with neighboring landowners, conservation organizations, and communities of practice
- Hosting yet another successful season of on-site research



Audubon

Appleton-Whittell
Research Ranch



The Huachuca Mountains viewed from the Research Ranch.
Photo: Steven Prager/Audubon Southwest.

Stewarding the Appleton-Whittell Research Ranch

Safeguarding a Critical Landscape

The Research Ranch is a rare example of still intact southeastern Arizona grasslands. With nearly 8,000 acres of this vastly diminished habitat type in our care and with Audubon priority birds like American Kestrel, Cassin's and Grasshopper sparrows, and Chihuahuan Meadowlark relying on its continued protection, preserving the ecological and research values of the Research Ranch is core to our mission.

A Little Water Goes a Long Way

Heavy winter rain in late 2022 was met with jubilation despite the management challenges it brought our way. Leaky roofs and deteriorated roads demanded our attention, but it was the response of the Ranch's most famous amphibian, the federally threatened Chiricahua leopard frog, that really stole the show. With ample water on the landscape, these frogs were able to expand beyond their original release locations and for the first time are being observed elsewhere on the Research Ranch. Unfortunately, American bullfrogs, an invasive species that poses a serious threat to our native

amphibians, were also able to take advantage of the situation. An immense effort by Research Ranch staff and collaborators was necessary to eradicate these invaders, but we were ultimately successful – underlining the unpredictable nature of managing the Research Ranch and our team's ability to conquer every challenge.

Saving Seeds for an Uncertain Future

Invasive plants are ubiquitous across western grasslands, often forming monocultures that exclude native species. Such monocultures are prone to blights and die-offs (i.e. bananas), and a common concern among grassland ecologists is that if such a scourge were to ever wipe out these monocultures, we'd be left without a native seed stock with which to facilitate restoration. That is why for 20 years we have worked to maintain a 350-acre almost entirely native patch near Research Ranch headquarters. While the work is extremely laborious, this patch may one day prove critical to the future of southeastern Arizona's grasslands, and maintaining that potential is well worth the effort.



Arizona State University herpetology field trip.
Photo: Adam Stein/Arizona State University.

Engaging the Community in Conservation

A Center for Conservation Action

The Research Ranch may be remote, but we depend on community. This year was marked by the return of programming that was put on hold during the Covid-19 pandemic as well as the beginnings of new offerings that give people a chance to engage hands-on with our conservation efforts. With nearly 900 volunteer-hours contributed this year and packed rooms for every event, we are forever grateful to those who brave our long, bumpy road to contribute to our mission.

The Return of Potluck Presentations

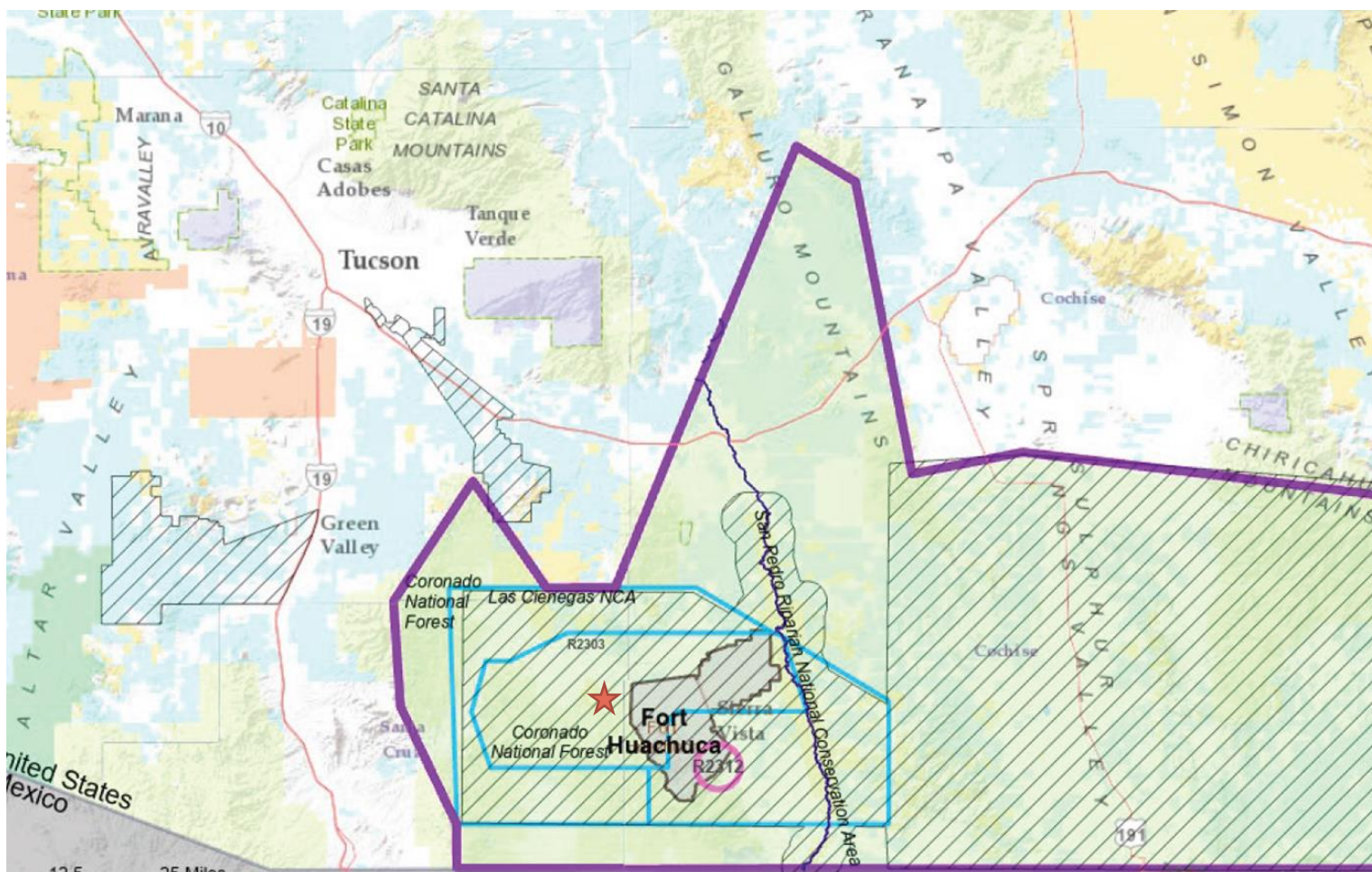
Once a month from January through May, we invite our followers to join us for a session of *Living Gently on The Land*, a combination between a community potluck and a conservation presentation focused on ways we can all be better to our non-human neighbors. The program had to be put on hold during the Covid shutdowns, but it only made our audience more excited to participate when the program returned this year. Presentation topics ranged from our tiniest desert springsnails to towering Emory oaks, and not one of our participants

ever left hungry. Keep an eye out for an announcement about next year's events.

Bringing Regional Programming to the Ranch

Audubon Southwest's Conservation Workdays are well known in the Phoenix area, but this year was the first in which the program made its way this far south. Putting a very Research Ranch twist on this familiar offering, we put volunteers to work transforming a management conundrum into promising conservation science.

Workday volunteers helped us and Phoenix-based Rattlesnake Solutions install two [artificial rattlesnake overwintering dens](#), allowing us to seal off problematic dens under the foundations of our staff and researcher housing units without worrying about leaving animals out in the cold. From here, we will be capturing snakes returning to these now-closed dens and relocating them to their new volunteer-built winter homes, and Rattlesnake Solutions will be working to monitor the moved animals. If successful, this work could serve to inform rattlesnake conservation efforts well beyond the boundaries of the Research Ranch.



The Fort Huachuca Sentinel Landscape, of which the Research Ranch is a part (★).
Photo: Fort Huachuca Sentinel Landscape/Department of Defense.

Collaborating Around Shared Goals

Conservation Beyond Our Fences

8,000 acres may sound like a huge area, and in many ways, it is. Our Sacaton plains rival most in the region, even the biggest herds of javelina can vanish into the grassy hills, and it is a long, long walk for anyone checking our most distant precipitation gauges. However, for the resident and migratory birds we seek to protect, it is not enough. To be successful, we must think beyond the borders of the Research Ranch. Fortunately, we are not alone in our collaborative thinking.

Collaborating at Scale

The Research Ranch sits within the jurisdictions of several watershed and landscape-scale conservation coalitions, and we have made it a priority to participate. Currently, Research Ranch staff are active members of several collaborative efforts including the Las Cienegas National Conservation Area Bio-Planning Team, the Upper San Pedro Watershed Partnership, and the Fort Huachuca's Conservation Planning Committee and Sentinel Landscape Restoration Partnership.

Priority Birds Tell the Story

In, March of 2022, the Research Ranch became the home of the first Motus (Latin for "movement") station in Arizona. This station, a small radio receiver capable of detecting passing birds wearing tiny radio transmitting tags, was born out of collaboration. Installed by the Bird Conservancy of the Rockies, it was put in place to serve as one of the westernmost stations in their ongoing studies of wintering Chihuahuan grassland birds. Science is always full of surprises though, and this year the station told an unexpected story.

On August 10th, a Western Yellow-billed Cuckoo, tagged and affectionately named "Hummus" by biologists with the Southern Sierra Research Station at Audubon's Kern River Preserve in California, [was detected on the Research Ranch](#) as it travelled south to its wintering grounds. Along the way, Hummus passed through at least six protected areas including restoration sites along the Colorado River. Thank you, Hummus - you have shown the value of collaborating across the landscape better than we ever could have without you!



Researchers from Phoenix-based Rattlesnake Solutions mark a western diamondback rattlesnake prior to relocation.
Photo: Bryan Hughes/Rattlesnake Solutions.

Enabling Conservation Research

We're Not Only About the Birds

What do hawkmoth caterpillars, Slevin's bunchgrass and ornate tree lizards, kissing bugs, Chihuahuan grassland birds, American bullfrogs, Chiricahua leopard frogs, Azure Bluebirds, Western Yellow-billed Cuckoos, Emory oaks, rare and endangered plants, groundwater, and soil eDNA all have in common? They were all the subject of study on the Appleton-Whittell Research Ranch in 2023! While we cannot take credit for the science facilitated by our visiting researchers, we can (and do) celebrate it loudly.

A Common Thread

The questions investigated on the Research Ranch are always diverse, but themes begin to develop in the face of high-level conservation challenges. With research questions asked this year including "how are rising temperatures and increased aridity affecting our native lizards?" and "what factors are behind observed declines in Emory oak recruitment?", the theme in 2023 was clear – climate change. As efforts are undertaken to mitigate the worst impacts of these global shifts, we are thrilled

to be able to help facilitate the science that will inform the work.

The Next Generation of Conservation Scientists

Each year, the Research Ranch offers three fellowship opportunities to students hoping to conduct on-site, conservation related research. This year, we were excited to award fellowships to Adriana Garcia Rivera and Mia Brann of Northern Arizona University and Matt Jenkins of the University of Arizona. Learn more about the work of our 2023 Research Ranch Fellows [here](#).

These fellowships are not just a tool for us to use in furthering conservation science, but they are also an opportunity to support and elevate young scientists of identities historically excluded from science and conservation. We look forward to expanding upon this effort in 2024, and we are already excited to celebrate our next round of student fellows.

2023 Research Summary

While we work hard to create education and hands-on-conservation opportunities for those looking to become involved with the work of the Research Ranch, research will always be our primary focus. As a controlled field research station, we are able to facilitate the work of the next generation of scientists and encourage the investigations needed to inform future conservation. Read on to learn more about this year's efforts and to dig into publications resulting from past work.

2023 Projects on the Research Ranch

(Did you conduct research on the Research Ranch in 2023 that is not represented below? Let us know by reaching out to researchranch@audubon.org.)

- **Audubon Southwest: Western Yellow-billed Cuckoo Survey**

The Western Yellow-billed Cuckoo was listed as a threatened species under the Endangered Species Act in 2014, and since 2015 we've been surveying for this imperiled bird within the riparian areas and oak woodlands of the Research Ranch. This year's effort was limited with only Post and Lyle Canyon transects surveyed, but we are looking forward to expanding the effort in 2023. Reports were provided to the Arizona Game and Fish Department and U.S. Fish and Wildlife Service and are available upon request.

- **Audubon Southwest/Arizona Important Bird Area Program: Grassland Sparrow Surveys**

The Research Ranch's designation as an Important Bird Area (IBA) is in part because of a suite of breeding grassland sparrows – Botteri's, Cassin's, Grasshopper, Rufous-winged, and others. To monitor these priority birds and to track differences between the Ranch and adjacent working lands, we survey each year three point-count transects, two on the Research Ranch and one on the adjacent Babacomari Ranch. Data and our most recent (2016) ten-year summary are available upon request.

- **Audubon Southwest: Appleton-Whittell Christmas Bird Count**

Each year in early January, the Research Ranch contributes to the annual Christmas Bird Count, North America's longest-running community science project, by coordinating and facilitating the Appleton-Whittell count. The effort takes the form of a 15-mile diameter circle with groups of volunteers recording all birds heard and seen within their preassigned area, and the results serve both to track trends in southeastern Arizona's wintering bird populations and to inform our conservation efforts. Check out this year's and past years' results [here](#).

- **Christian D'Orgeix – Virginia State University: Testing Hypotheses of Genetic Variance, Metabolism, and Lizard Extinction Patterns Based on Elevation**

Global climate change is predicted to cause a worldwide 39% extinction rate of local lizard populations, and extinction rates of Mexican and southeastern Arizona *Sceloporus*, or spiny lizard, species may reach as high as 58% by 2080. Additionally, it is hypothesized that high elevation species will become extinct more rapidly because of their inability to move uphill to escape rising temperatures. Through the study of *Sceloporus* lizards including Slevin's bunchgrass, Yarrow's spiny, and striped-plateau lizards, this investigation hopes to look into questions surrounding these hypotheses such as if climate change is influencing the size of these animals, whether or not high and low elevation populations of the same species are adapted to their particular environments morphologically and physiologically or if these factors are genetically fixed, and if sympatric species react similarly to environmental disturbances such as fires, drought, and climate change.

- **Renee Duckworth - University of Arizona: Characterizing Variation of Azure Bluebirds**

The Azure Bluebird (*Sialia sialis fulva*) is a subspecies of the Eastern Bluebird, and this study seeks to better understand the extent of divergence between it and its eastern counterparts. By assessing genetic, morphological, and behavioral traits and comparing findings to prior studies of other subspecies in this group, Dr. Renee Duckworth and her students hope to determine whether Azure Bluebirds are sufficiently unique to warrant higher-level taxonomic status and to understand the mechanisms underlying their divergence from other *Sialia* populations.

- **Bryan Hughes - Rattlesnake Solutions: Experimental Relocation of Rattlesnake Overwintering Dens**

To assess the usefulness of the two artificial rattlesnake overwintering dens installed on the Research Ranch this

year, Rattlesnake Solutions and Research Ranch staff are now actively capturing, photographing, relocating, and monitoring snakes observed returning to the now-closed historic den sites beneath buildings on the Research Ranch. Future efforts will include both more rigorous mark/recapture methodology and more in depth monitoring of conditions at and snake usage of the artificial dens.

- **Linda Kennedy and Dan Robinett: Upland (Ecological Site) Vegetation Monitoring**

Starting in 2003, twenty-three vegetation transects have been established throughout the Research Ranch, based largely on Ecological Sites mapped by USDA-Natural Resource Conservation Service. These transects are positioned on all major ecological sites, at least one is on land administered or owned by each partner of our landowning partners, and at least one is within our invasive grass treatment area. Ranch staff and volunteers read the transects in the fall to capture the status post monsoon. These transects identify trends in vegetation and ground cover, provide support for research projects, are used by agencies as reference areas, serve as training venues, and yield information for education and outreach efforts. Most recently, Linda Kennedy and Dan Robinett incorporated results from several transects into an invited presentation on grasslands for the Tucson Chapter of the Arizona Native Plant Society, [available on their YouTube channel](#).

- **Richard F. Lance – U.S. Army Engineer Research and Development Center: eDNA Bioindicators of Soil Provenance**

There is likely a wealth of environmental information that can be obtained from soil environmental DNA (eDNA). However, for eukaryotic taxa, the reservoir of environmental information represented by soil eDNA is largely undescribed. This project is focused on understanding patterns in eukaryotic eDNA in soil and the degree to which these patterns can be used as bioindicators for soil ecological affiliations and points of origin. Soil collected on the Research Ranch this year will be used as test samples for evaluating developing soil classification models, and results may contribute to eventual soil eDNA capabilities useful in natural resource management and conservation.

- **Matthew Lattanzio - Christopher Newport University: Evolutionary and Ecological Responses of Lizard Populations to Natural and Human Induced Changes in Environmental Conditions**

Through field and lab-based study of several southwestern lizards, this work aims to further our understanding of how species interact with their environments, how key evolutionary and ecological processes contribute to those interactions, and how they have responded to natural and human-caused changes in environmental conditions such as those resulting from grazing, prescribed fire, urbanization, and climate change. Results from these studies will provide valuable information to land managers and conservationists interested in the consequences of environmental changes for biodiversity.

- **Andrew Salywon – Desert Botanical Gardens & Ron Tiller/Arizona Department of Environmental Quality: Groundwater Monitoring**

This project monitors three shallow groundwater wells installed in the late-1990's. These wells are located in the bottomlands of Post and O'Donnell canyons, two of the Research Ranch's primary drainages, and were initially installed to understand the water requirements of the bunchgrass big sacaton (*Sporobolus wrightii*) and its namesake floodplain grasslands. Now, however, these wells are helping to understand how groundwater levels respond to precipitation, stormflows, drought, and extreme temperatures. In June 2015, all three wells were outfitted with transducers to measure water levels at 30-minute intervals. Since then, the project has accumulated an almost continuous record of water levels.

- **Arthur Woods - University of Montana and Jon Harrison – Arizona State University: The Causes and Consequences of Color Polyphenism in *Manduca* Caterpillars**

Manduca sexta caterpillars exhibit remarkable color polyphenism: while most caterpillars remain green in color throughout their development, some turn dark brown to black. Through the study of these caterpillars across varied sites and habitats, this investigation hopes to reveal what about their environments the caterpillars are perceiving, how they perceive it, how the information is transduced into morphological, physiological, and/or behavioral change, and what the consequences of these changes are to individuals in their particular habitat.

- **Louisa Messenger - University of Nevada: Kissing Bugs**

In parts of Latin America, Chagas disease, a parasitic infection transmitted by triatomine bugs (*Hemiptera*;

Reduviidae; Triatominae - AKA “Kissing Bugs”), affects as many as six to eight million individuals and kills as many as 50,000 people annually. The etiological agent, *Trypanosoma cruzi*, is distributed from the Southern United States to Argentinean Patagonia, but not all kissing bugs are made equal in their likeliness to transmit the disease. Through the collection of these bugs by community scientists and investigations of *T. cruzi* infection prevalence and genetic diversity and triatomine bug genetic diversity, bloodmeal preferences, and microbiome composition, researchers hope to learn more about the risk posed by Chagas disease in the southwest United States.

- **Meryl Mims - Virginia Tech: Simulating Metapopulations and Removal Tactics for Strategic Invasives Management (SMARTSIM): a Data-Driven, Multi-Species Simulation Framework for Effective Management of Aquatic Invasive Species in the United States.**

Managing invasive species is complex, and tools with which to address spatial and multi-species challenges are limited. Through collaboration with the U.S. Forest Service and with a focus on American bullfrogs and Chiricahua leopard Frogs, this project aims to test and transfer efficient and effective management strategies that optimize the control of invasives while promoting the persistence of at-risk species. By developing strategies and tools to inform efficient management decisions, this research has the potential to benefit land managers, conservationists, and priority species across the southwest.

- **Sara Souther - Northern Arizona University: Projecting Socio-Ecological Impacts of Drought in Southwestern Ecosystems to Prioritize Restoration**

For Indigenous communities, culture and ecology are intertwined and local species are often used for practical and/or ceremonial purposes. In Arizona and New Mexico, several tree species important to local Tribes are facing declines resulting from unprecedented ecological change, putting habitats and traditions at risk. As part of a broader, regional effort focused on several species, study plots on the Research Ranch are focused on identifying abiotic and biotic drivers of decline and resiliency in populations of Emory oak and, using these monitoring data, researchers hope to inform the development of effective, science-based management strategies to sustain the species long-term.

- **Sara Souther - Northern Arizona University: Conservation of the Endangered Species *Pectis imberbis***

Pectis imberbis, known by its common name “beardless chinchweed”, is a relative of the sunflower that was listed as an endangered species by the U.S. Fish and Wildlife Service in 2021 - in the United States is known only from the Coronado National Memorial, portions of the Coronado National Forest, and the Research Ranch. Study of *Pectis imberbis* on the Research Ranch is aimed at better understanding how this recently listed and often overlooked plant responds to grazing, competition with invasive species, fire, and human disturbance. Data from this work will serve to inform ongoing recovery efforts.

- **Matt Webb – Bird Conservancy of the Rockies: Chihuahuan Birds Motus**

Chihuahuan desert grasslands are disproportionately valuable to North America’s breeding grassland birds (of the 34 grassland obligate species nesting in the Great Plains, 85% overwinter in the Chihuahuan desert). Unfortunately, this habitat type is in steep decline and data describing Chihuahuan desert grasslands bird distribution, abundance, and habitat requirements are limited. Using the Motus station they installed during a collaborative workshop on the Research Ranch in 2022 as one of the westernmost outposts in their monitoring network, the Bird Conservancy of the Rockies is seeking to fill these data gaps and, through partnerships in both the United States and Mexico, develop a platform for Chihuahuan desert grassland bird conservation.

Publications Received Since the Last Research Ranch Annual Report*

(We are working on building a digital bibliography for the Research Ranch website! If you have published work between 2017-2023 and do not see it listed below, please send information to researchranch@audubon.org.)

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*The last Research Ranch annual report was produced in 2017. Expect a yearly report from this point forward!

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