

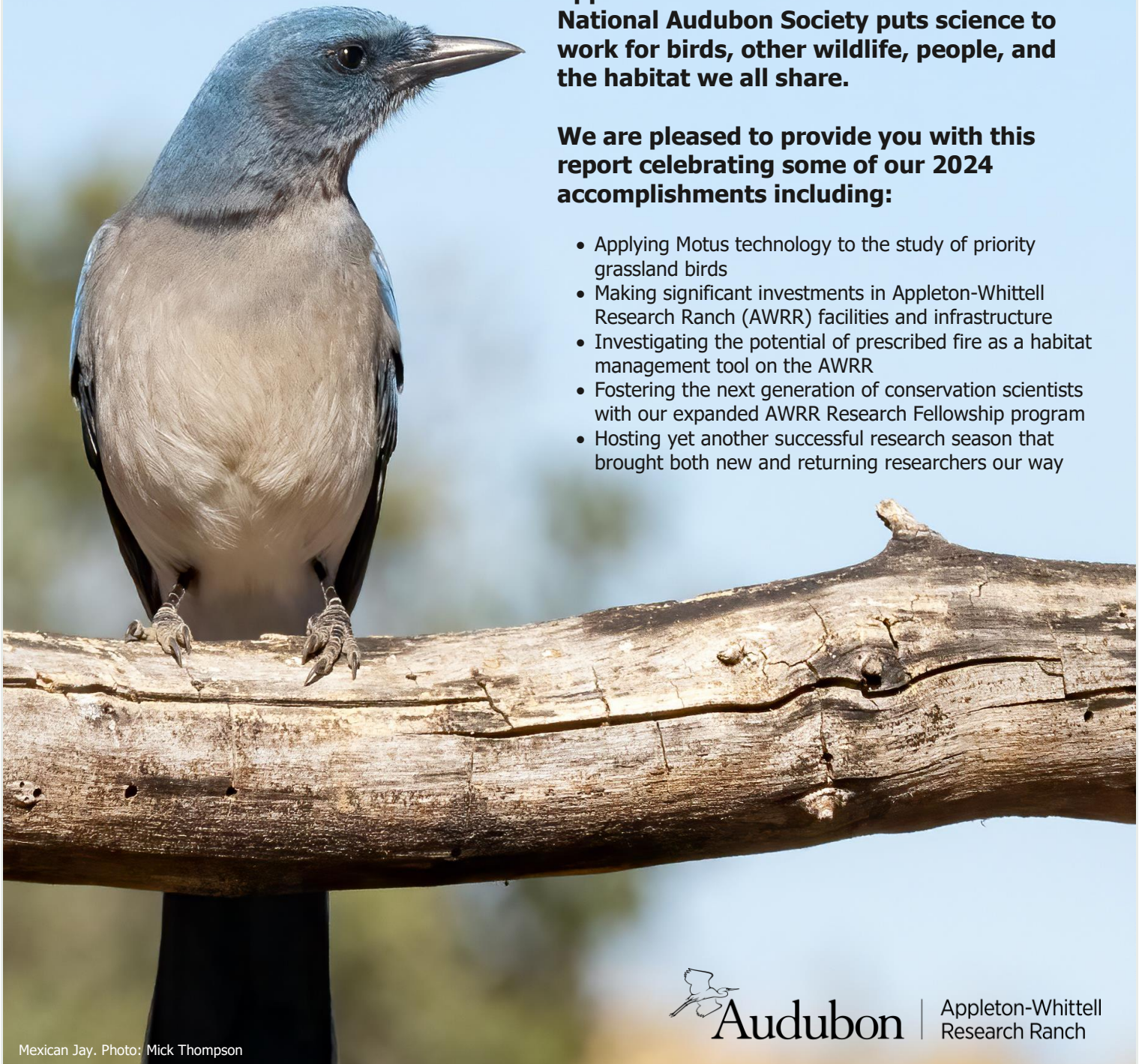
Appleton-Whittell Research Ranch of the National Audubon Society

2024 Annual Report

**Part field research station, part sanctuary,
and part Audubon action center, the
Appleton-Whittell Research Ranch of the
National Audubon Society puts science to
work for birds, other wildlife, people, and
the habitat we all share.**

**We are pleased to provide you with this
report celebrating some of our 2024
accomplishments including:**

- Applying Motus technology to the study of priority grassland birds
- Making significant investments in Appleton-Whittell Research Ranch (AWRR) facilities and infrastructure
- Investigating the potential of prescribed fire as a habitat management tool on the AWRR
- Fostering the next generation of conservation scientists with our expanded AWRR Research Fellowship program
- Hosting yet another successful research season that brought both new and returning researchers our way





Photographing a Cassin's Sparrow recently marked with a solar powered Motus tag.
Photo: Steven Prager.

Putting New Technology to Work for Grassland Sparrows

Understanding Avian Movement Through Motus

More common in the Eastern U.S., Motus (Latin for "movement"), is a network of radio stations equipped to pick up signals sent from tiny, radio-emitting tags that can be affixed to insects, bats, and of course birds. With a little help from the Bird Conservancy of the Rockies, the AWRR Motus station was installed atop Bald Hill in March of 2022. Since then, it's been picking up birds tagged elsewhere by other researchers (including a federally threatened [Western Yellow-billed Cuckoo](#) tagged at Audubon's Kern River Preserve in California), and we've been dreaming up ways to put it to use for our own investigations.

Unraveling the Mysteries of Grassland Sparrows

Take out your nearest field guide and look up Cassin's, Botteri's and Cassin's sparrows, three of the grassland specialist sparrows found here on the AWRR. Peak at the range maps and you'll see that all are shown to be year-round residents on the ranch

but ask our staff to point one out in winter and you're going to get some funny looks. These birds all but disappear in the winter, but is that because they've moved on to greener pastures or because they're living like mice silently below the grass? Fortunately for us, the AWRR is the perfect place to find out.

Leaning on Partners to Make it Happen

Thanks to financial support from the Arizona Game and Fish Department (AZGFD) and field assistance from the Sonoran Joint Venture, Arizona State University, AZGFD, Tucson Audubon, and the Southern Sierra Research Station, we now have nearly 20 AWRR sparrows equipped with motus tags. Over the next many summers, we'll be working together to track these birds' seasonal movements and to explore yet another piece of new technology – Motus repeater boxes that allow us to pinpoint tagged birds' precise locations and consider more site-specific questions. The more we know about priority birds on the AWRR the better we can tailor our efforts to benefit them. We can't wait to see what these newly tagged birds teach us!



The Sonoita-Elgin Fire District assessing the scene after the 2018 Babo Fire, the most recent significant burn on the AWRR. Photo: Linda Kennedy.

Building Community Around Fire Management

An Altered Landscape

Arizona's grasslands evolved with fire, so it's easy to think that returning fire to the landscape would be an easy conservation win. We wish it were so simple.

Extremely responsive (and appreciated!) fire crews rarely allow fires that start outside of the AWRR to reach our borders and, while there have been periodic fires on the AWRR, some of them quite significant, the Ranch doesn't regularly burn as it historically would have. Combine this with the exclusion of cattle, changes in flora, and the warmer, drier days brought on by climate change, and you have a landscape that is likely to burn much differently than it once did. Complicating things even further, our most problematic invasive grasses can benefit from typical prescribed burns at the expense of native species.

Exploring the Possibilities

Despite the risks and unknowns, prescribed fire is still one of the few land management tools that can be applied efficiently at scale, and the AWRR offers a perfect laboratory where new methods can be

explored, and best practices can be identified. That's why this fall we convened the experts – wildland firefighters, land management agencies, conservation non-profits, universities, researchers, ranchers, and more – to start a conversation around bringing fire back to the ranch. Together, we explored the question of whether fire is an appropriate tool to explore here on the AWRR and how to approach eventual burns in a way that allows us to try new methods, evaluate impacts, and inform management beyond our fences.

Balancing Risk and Opportunity

Two agreements rose immediately to the top during the first meeting of our prescribed fire working group. The first was that there is great opportunity on the AWRR to study the effects of prescribed fire and inform best practices regionwide. Second was that, with so much value tied to the habitat found on the AWRR, large acreage burns are too risky. These agreements will guide our planning as we work to develop an AWRR burn plan and research program in 2025 and beyond.



The Swinging H Ranch House over time.
Photos: Top left – Mark Stromberg; Top right – Linda Kennedy; Bottom: Steven Prager.

Investing in Critical Infrastructure

Breathing New Life into the Swinging H

Whether you were a researcher who's days in the field ended in one of its many beds, a birder who saw your first Montezuma Quail perched atop its backyard wall, or a volunteer who appreciated that its dining table was big enough for the entire team, if you've ever spent a night in the Swinging H Ranch House, it's likely an experience you've not forgotten.

The Swinging H is older than the Research Ranch itself, reportedly moved from Fort Huachuca in the mid-1900's to its current location on what was then the Clark Ranch. Attempts to pin down its exact origin have been attempted, but because of the many changes the building has undergone – lost and added windows, new doors, add-ons, and more paint colors than we can count – its story is still wrapped in mystery. Regardless of where it came from, over the years it has become critical to so much of what we do here on the AWRR, and it has earned a place in the hearts of the countless researchers, volunteers,

birders, and other visitors that have called it their temporary grassland home.

But sadly, to anyone who visited the Swinging H over the last few years, it was clear that the Swinging H needed a little attention. The once tan paint had faded to a ghastly shade of pink, the furniture bore the obvious signs of many decades of sweaty researchers, and the holes in the siding allowed for many critters that, while appreciated outdoors, most would prefer not to wake up to in the middle of the night.

This year, with the longevity of the building in question, we decided it couldn't wait a moment longer and got to work. So far, we've removed the old siding, applied fresh coats of stucco and paint, repaired the backyard gates, replaced the old couches and chairs, and swapped out the raggedy old curtains for new, clean blinds. More improvements are forthcoming, but for now, we're happy to report the Swinging H is ready for the next group lucky enough to stay the night at the AWRR.



Our 2024 AWRR Research Fellows (Left to Right: Emma Sudbeck, University of Arizona, Marcus Williams, Christopher Newport University, Laura Nicholson, Northern Arizona University. Photos provided by individual Research Fellows.

Providing New Opportunities to Our Newest Researchers

Investing in the Next Generation of Scientists

Each year, we offer scientists between the ages of 18 and 30 the opportunity to apply for one of three positions as an Appleton-Whittell Research Ranch Fellow. Each of the three recipients receives a \$1000 dollar stipend to be spent on anything from research equipment, to travel, to basic supplies and a \$500 AWRR housing stipend that affords them nearly two weeks' worth of overnight stays on the ranch. Not only is this our opportunity to support the next generation of conservation and research scientists, but it also gives us the chance to encourage the sort of research we most want to see conducted on the AWRR – research that helps us answer questions critical to the conservation of the flora, fauna, and habitats found on the ranch.

Prioritizing Diversity

By weighing need, demographics, and equitability and inclusiveness of research questions alongside the conservation value of Fellowship applications we

receive, we are able to use this program to elevate scientists of identities or from communities historically excluded from science and conservation. This approach helps us broaden our community of researchers and uplifts research questions and applications that otherwise may have been overlooked.

Expanding Opportunities

New to the AWRR Fellowship program this year was our [Appleton-Whittell Research Ranch Fellow Webinar Series](#). During these lunchtime webinars, our 2024 fellows gave audiences a glimpse into their time on the AWRR, their work, and its conservation implications. More than 200 members of the Audubon flock registered for these three webinar sessions.

Next year, thanks to a generous contribution from the Research Ranch Foundation, we'll be doubling our impact by offering a \$2,000 stipend and \$1,000 housing voucher to each Fellow. We couldn't be more excited to see the faces and projects the expanded program brings our way.

2024 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. An unparalleled field research station, the Research Ranch elevates the next generation of scientists and facilitates the investigations needed to answer the questions most critical to the conservation of birds, other wildlife, and grassland ecosystems. Read on to learn more about this year's efforts and to dig into publications resulting from past work.

2024 Projects on the Research Ranch

* New to the AWRR this year

** AWRR Research Fellow

(Did you conduct research on the Research Ranch in 2024 that is not represented below? Let us know by reaching out to researchranch@audubon.org.)

- **Audubon Southwest: Appleton-Whittell Christmas Bird Count**
Each year in early January, the AWRR contributes to the annual Christmas Bird Count, North America's longest-running community science project, by coordinating 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](#).
- **Audubon Southwest: Nightjar Survey**
One night each spring, AWRR staff drives into the night to survey the area's nightjars (poorwills, nighthawks, and others) as part of a nationwide community science project coordinated by the Nightjar Survey Network and the Center for Conservation Biology. Information about how to get involved and data from this and previous years' surveys are available [here](#).
- **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 the summer of 2024. Reports were provided to the Arizona Game and Fish Department and U.S. Fish and Wildlife Service and are available upon request.
- **Audubon Southwest: Upland (Ecological Site) Vegetation Monitoring:** In 2003, twenty-three vegetation transects were established across the Research Ranch by then-Director Linda Kennedy. Sited using data provided by the USDA-Natural Resource Conservation Service, these transects are positioned on all major ecological sites with at least one on land administered or owned by each of our landowning partners and one within our invasive grass treatment area. Ranch staff and volunteers survey a subset of these transects each fall to build a long-term dataset describing the AWRR's post-monsoon flora. The 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 help us assess the effectiveness of our invasive grass management efforts. A report detailing this year's efforts is available upon request.
- **Audubon Southwest and the 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, Arizona Game and Fish Department, and the University of Arizona: Chiricahua Leopard Frog Monitoring and Safe Harbor Site Management**

At multiple locations across the AWRR, natural and artificial wetlands host populations of Desert Pupfish (listed as Endangered in 1986) and Chiricahua Leopard Frogs (listed as Threatened in 2002). These sites are part of the Arizona Game and Fish Department's efforts to bring these species back from the brink, and to do our part we conduct annual Chiricahua Leopard Frog surveys. Data from these surveys include counts of adult frogs, tadpoles, and egg masses as well as information describing the condition of the sites. These data are submitted annually to the Arizona Game and Fish Department.
- *Audubon Southwest, Arizona Game and Fish Department, Sonoran Joint Venture, Southern Sierra Research Station, and Tucson Audubon: Grassland Sparrow Motus Project:** More common in the Eastern U.S., Motus (Latin for "movement"), is a network of radio stations equipped to pick up signals sent from tiny, radio-emitting tags that can be affixed to insects, bats, and of course birds. With a little help from the Bird Conservancy of the Rockies, the AWRR Motus station was installed atop Bald Hill in March of 2022. Thanks to our collaborators, we now have nearly 20 AWRR sparrows (Botteri's, Cassin's, and Grasshopper) equipped with motus tags. Over the next many summers, we'll be working together to track these birds' seasonal movements and use of habitat on the AWRR. Follow our Motus station and the birds it detects [here](#).
- *Maria Fernanda Bandeira de Melo Galletti– Centers for Disease Control and Prevention: MALDI-TOF based identification of the *Amblyomma maculatum* population in the United States**

To improve tick surveillance in the United States, proper species level identification is needed. The current project aims to use a novel molecular protein-based identification method to determine which *A. maculatum* populations are present within Santa Cruz County habitats. The results obtained in this work will be part of the first database of tick protein spectra worldwide, accessible to public health investigators and medical entomologists, improving availability, accuracy, and speed of tick identification and tick-borne pathogen surveillance in the U.S. and other countries.
- *Joe Cicero – Xerces Society (retired): Elucidating Life Cycle Stages of Fireflies with Flightless Females**

In many species of fireflies, morphological differences between larva and adults of both sexes create situations in which the flashy male is known to species but is not associated with conspecific larva or female. Following up on an observation made by AWRR staff in 2023 and another made by AWRR researcher Candace Fallon, this study aims to identify to species a flightless female firefly known from the mesas of the ranch. It is suspected that the observations, both made near *Pogonomyrmex* ant colonies, were of *Prolutacea pulsator*, a firefly species with an unknown larva and an unverified female form. The only other suspect is *Paraphausis eximius*, a species with an unknown larva and an unknown but presumed-flightless female. This study aims to collect flightless female and larva (to be reared in captivity) so that they may be identified to species, filling gaps in knowledge in our understanding of these beetles.
- 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.
- *Candace Fallon – Xerces Society: Firefly (Lampyridae) surveys at the Appleton-Whittell Research Ranch, AZ**

The purpose of this study is to generate firefly species occurrence data to better understand the distribution of data-deficient and potentially imperiled (but currently unlisted) firefly species. In addition, the study aims to provide the Audubon with a better understanding of the firefly species that occur on the AWRR and to develop management recommendations to conserve these species and their habitats.

- Sam Fernald – New Mexico State University and Anne Cross – Tulsa Community College: Soil Moisture and Lehmann Lovegrass**

Lehmann Lovegrass (*Eragrostis lehmanniana*) is among the most problematic invasive species found on the AWRP. Better understanding of water, soil, nutrient, and plant relationships in regard to Lehmann Lovegrass may help to improve management of this invasive grass and reduce its impact on ecosystem health. This study measures soil moisture and vegetation cover and density of invasive and native grasses. It also provides a longitudinal study that includes occasional measurements of production, nutrients, and other parameters to help inform invasion dynamics.
- 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, tagging, photographing, relocating, and monitoring snakes observed returning to the now-closed historic den sites beneath buildings on the Research Ranch. Additions to the project this year include more rigorous mark/recapture methodology and more in depth monitoring of conditions at and snake usage of the artificial dens.
- Matt Jenkins – University of Arizona: Genetics, behavioral flexibility, and experience in Azure Bluebird nest box use**

A distinct and isolated subspecies of Eastern Bluebird, Azure Bluebirds (*Sialia sialis fulva*) are secondary cavity nesters, meaning that they nest within the old, abandoned nests of cavity excavators like woodpeckers (primary cavity nesters). Without large, old trees in which to nest, Azure Bluebirds are in trouble. The obvious patch-fix is to provide artificial nesting sites, but while Eastern Bluebirds in the eastern United States take quickly to nest boxes, it's been found to be more complicated in the southwest. To most effectively help Azure Bluebirds, a bird listed by the Arizona Game and Fish Department as a Species of Greatest Conservation Need, we need to more fully understand what factors are behind their decisions and this project aims to investigate the roles that genetics, behavioral flexibility, and experience play.
- 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 during this and last 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.
- Rachel Laura – Northern Arizona University/U.S. Fish and Wildlife Service: Shining a Light on an At-Risk Species: Investigations into the Abundance and Habitat Requirements of an Imperiled Arizona Firefly**

Petitioned for listing by the U.S. Fish and Wildlife Service in 2023, the Southwest Spring Firefly (*Bicellonycha wickershamorum wickershamorum*) can be found at marshy, ephemeral sites along canyons and streams and at seeps and springs in the mountains and foothills of the Madrean Sky Islands. This project aims to identify and assess populations of this firefly in preparation for the upcoming species status assessment.

The AWRR is home to significant populations of this imperiled firefly, and this year it was added to the growing list of surveyed locations.

- **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.

- ****Laura Nicholson – Northern Arizona University: Emory Oak and an Investigation of the Emerging Pathogen *biscogniauxia***

A keystone plant in southeastern Arizona, Emory Oak feeds birds like the Montezuma Quail, Mexican Jay, and Acorn Woodpecker. Just as importantly, Emory Oak acorns have long been gathered and consumed by Indigenous communities including the Yavapai, Tonto, San Carlos, and White Mountain Apache Tribes. This project aims to understand how emerging pathogens, drought, climate change, and other threats may be impacting Emory Oak survival and to provide practical steps that can be taken to protect the this tree and the southwestern ecosystems and communities that depend on it.

- **Grace O'Malley – Virginia Tech: Investigating the breeding phenology of a threatened amphibian (*Hyla wrightorum*)**

The Arizona Treefrog (*Hyla wrightorum*) is a small green and black treefrog listed as a Species of Greatest Conservation Need by the Arizona Game and Fish Department that is found mostly above the Mogollon Rim in Arizona and eastward into New Mexico. Smaller and less well understood populations exist in Huachuca Mountains and Canelo hills, and animals are periodically encountered on the AWRR. This project is using acoustic recorders to investigate this species' breeding phenology and to address knowledge gaps in its spatial and temporal dynamics in the region.

- ***Katherine Parys – United States Department of Agriculture: Beenome100**

The United States Department of Agricultural and Agricultural Research Service are involved in an effort called [Beenome100](#) which aims to "sequence, assemble, and annotate the genomes of 100 U.S. bee pollinators, while also strengthening resources for the honey bee, a key pollinator and insect model". Collection visits to the southwestern U.S. are a key part of this effort because of the region's incredibly high bee diversity, and this year the AWRR was added to the list of collection sites.

- ***Daniel Rubinoff – University of Hawaii: Phylogenomics of *Hemileuca* and the Evolution of Pheromone Divergence**

Moths in the genus *Hemileuca*, of which there are about thirty, are brightly colored moths ranging from southern Canada to southern Mexico. As a complex group of moths that across species show varied phenology, a wide range of host plants from grasses to trees, diversity in behavior with nocturnal and diurnal examples, and isolated conspecific populations often with unique pheromones, they make for an interesting model through which to understand speciation and pheromone evolution. This project aims to

sample populations of *Hemileuca* moths in each species group across their range, and this year the AWRR served as home base for collection on the Coronado National Forest.

- **Andrew Salywon – Desert Botanical Gardens & Ron Tiller - Arizona Department of Environmental Quality: Long-term 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.
- ***Kerry Schwartz - Friends of Sonoita Creek/Sky Island Alliance: Spring Seeker Surveys**
Spring Seekers is a community science project facilitated by the Sky Island Alliance that aims to map and assess the health of springs in the Sky Islands region. This year, the AWRR's Finley Tank, a wildlife pond fed by a healthy natural spring, was added to their [map](#) and surveys were conducted by Friends of Sonoita Creek volunteer Kerry Schwartz.
- **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.
- ****Emma Sudbeck – University of Arizona: Population Ecology of the Invasive American Bullfrog in Southeast Arizona**
Stocked into Arizona's waters by the Arizona Game and Fish Department from the 1920s into the early 1980s as a game (hunting) species, American bullfrogs (*Lithobates catesbeianus*) were quick to overwhelm native aquatic wildlife and those tasked with managing it. Using mark-recapture and radio telemetry techniques, this study will help further our knowledge of American bullfrog natural history and provide wildlife managers with information that allows them to leverage their limited resources by identifying sites and seasons during which removal efforts will have the greatest impact.
- **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 decline and data describing Chihuahuan desert grasslands bird distribution, abundance, and habitat requirements are limited. Using the Motus station installed during a 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.

- ****Marcus Williams – Christopher Newport University: Eyes of Three to Regulate Ultraviolet Light - Investigating the Role of the Parietal Eye in the Ornate Tree Lizard**

Lizards require exposure to ultraviolet light, but how they detect and regulate it is poorly understood. It is possible that lizards' parietal eye, a light detecting organ that sits atop the heads and between the true eyes of many lizards, frogs, salamanders, and fish, might be the answer. While we know it plays a role in the detection of light, our understanding of its full function is limited. This project aims to unravel the mystery through field and lab-based study of Ornate Tree Lizards (*Urosaurus ornatus*) on the AWRR.

Publications Received Since the 2023 Field Season

(If you published work resulting from time spent on the Research Ranch that is not listed below, or if you have published works related to the Research Ranch that are not listed in our [online bibliography](#), please send information to researchranch@audubon.org.)

Beauregard, Nicholas. "Identification and Evaluation of Yellow-Billed Cuckoo Habitat Using Acoustic Monitoring and Species Distribution Model Methods." Diss. Northern Arizona University, 2023.

Beauregard, Nicholas D., et al. "Breeding by western Yellow-billed Cuckoos in xeroriparian habitat in southeast Arizona." *Journal of Field Ornithology* 95.4 (2024).

Beauregard, Nicholas D., et al. "Using autonomous recording units to identify and monitor western yellow-billed cuckoo habitat." *Wildlife Society Bulletin* 48.3 (2024): e1546.

Goerge, Tyler M., and Donald B. Miles. "Behavioral plasticity during acute heat stress: heat hardening increases the expression of boldness." *Journal of Thermal Biology* 119 (2024): 103778.

Haidar, Zeinab M. "Genetic evaluation of the current distribution and possible differentiations between *Lasiurus borealis* and *Lasiurus frantzii* in southwestern North America." (2023).

Moore, Chloe E., and Meryl C. Mims. "Sampling through space and time: multi-year analysis reveals dynamic population genetic patterns for an amphibian metapopulation." *Conservation Genetics* (2024): 1-18.

Rivera, Adriana Garcia. *Identifying Patterns of Seed Dispersal and Predation Across the Emory Oak (Quercus emoryi Torr.) Range in Arizona*. MS thesis. Northern Arizona University, 2024.

Schultz, Andreanna. *Beyond Thermoregulation: UV and Temperature Regulation Along an Elevation Gradient in Ornate Tree Lizards*. MS thesis. Christopher Newport University, 2024.

Strom, Stephen E. *Forging a Sustainable Southwest: The Power of Collaborative Conservation*. University of Arizona Press, 2024

Walker, John-Lee Sky, et al. "Improved amplification of fecal DNA supports non-invasive microsatellite genotyping of lesser long-nosed bats (*Leptonycteris yerbabuenae*)." *Conservation Genetics Resources* 16.1 (2024): 159-171.

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Instagram: https://www.instagram.com/audubon_research_ranch/

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