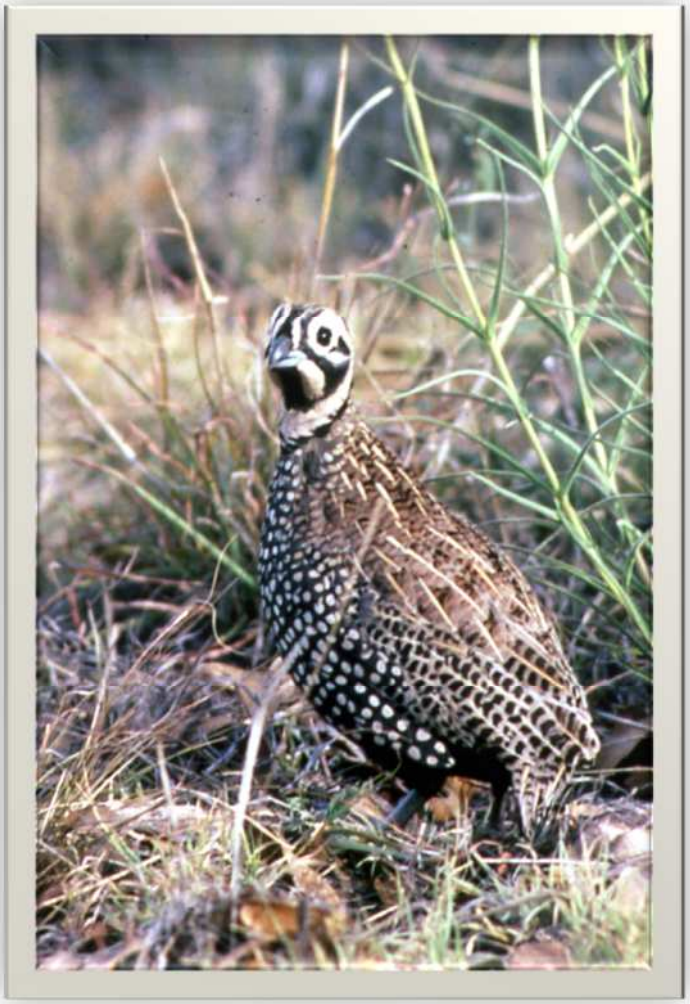
4th Annual
Science on the Sonoita Plain



Quarterly Meeting of the Sonoita Valley Planning Partnership
June 9, 2012

At the
Appleton-Whittell Research Ranch of the National Audubon Society
Elgin, Arizona

The Sonoita Valley Planning Partnership (SVPP) is a voluntary ad hoc association of agencies, user groups, conservation organizations, and individuals working together to achieve community-oriented solutions to local and national issues affecting public lands within the Sonoita Valley. The SVPP was created in 1995 in response to BLM's initiation of a collaborative planning process for Las Cienegas National Conservation Area. The SVPP meets quarterly and provides a forum for participants to share information and work together to perpetuate naturally functioning ecosystems while preserving the rural, grassland character of the Sonoita Valley for future generations. The SVPP is now administered and supported by the Cienega Watershed Partnership, a 501c(3) non-profit organization that was founded in 2007 to facilitate cooperative actions that steward the natural and cultural resources of the Sonoita Valley while enabling sustainable human use.

The Science on the Sonoita Plain symposium was established to bring together and share the results of scientific investigations that are occurring within and informing us about the unique and diverse resources of the Sonoita Plain in the upper watersheds of Cienega Creek, Sonoita Creek, and the Babocomari River.

This year, the focus was on birds with updates on new and continuing scientific efforts on other topics. We hope you enjoy this recap of the 4th annual Science on the Sonoita Plain Symposium.

Gita Bodner, The Nature Conservancy
Linda Kennedy, National Audubon Society
Karen Simms, Bureau of Land Management
Jeff Williamson, Cienega Watershed Partnership

We gratefully acknowledge the financial support provided by
Resolution Copper Company for the lunch and proceedings.

Thanks also to:
Shela McFarlin for organizing the refreshments provided by the
Cienega Watershed Partnership
Amy Markstein and Leslie Uhr for technical support,
Dave Bertlesen for serving as timekeeper.

Photos courtesy of
Mark Stromberg, Linda Kennedy & Gita Bodner

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4:00 – Adjourn

A Certified Professional in Rangeland Management
Continuing Education Workshop
6 CEUs

Welcome!

Karen Simms, currently taking a break from her position as Ecosystem Planner for Las Cienegas NCS to take up a new role as Acting Field Assistant Manager for the Tucson District of the Bureau of Land Management, welcomed all to the event. Refreshments were provided by the Cienega Watershed Partnership and the Research Ranch.

Keynote Address

The Ecology and Conservation of Grassland Sparrow Populations

H. Ronald Pulliam, Regents Professor Emeritus Odum School of Ecology at the University of Georgia

In the 1970's and early 1980's, I conducted a number of basic research projects at The Research Ranch focused on understanding how seed production and cover influenced the abundance, distribution, and diversity of wintering grassland

sparrows. I attempted to determine the factors determining the relative abundance of sparrow species and permitting the coexistence of multiple species. I also conducted field and laboratory studies on seed selection by grassland sparrows.

I focused on the role of seed production in determining sparrow abundance and diversity. I established a number of survey plots in habitats including open grasslands, sacaton bottoms, and oak woodland. I measured seed production with seed traps in each habitat and supplemented the seed trap data with measurements of seed density in the soil. By combining seed trap data with soil samples, I was able to measure total seed production for each habitat and follow the rate of seed depletion through the winter months. Since the studies were conducted over a number of years I was able to see a wide range of conditions and see how sparrows responded to spatial and temporal variation in seed availability.

I also conducted intensive studies of sparrow diets including laboratory studies of feeding efficiency and field studies of diets. I developed a non-lethal method using an emetic to study seed consumption in the field and tested hypotheses about how habitat and seed selection varied between years of high and low seed availability. I studied how predation and seed production interacted with grass density and tree and shrub cover to influence habitat use. In addition to observational studies, I conducted field experiments by manipulating seed abundance, tree density, and risk of predation. I supplemented natural seed production by adding native seeds of different sizes to experimental plots. I both removed and added tree (mesquite) cover and I flew trained hawks to see how predation influenced habitat selection. I have published a series of papers in peer-reviewed journals detailing results of the studies (see list below)

Some of the primary results relevant to sparrow conservation are as follows:

1. Grass seed production occurs primarily in the late summer and fall following summer rains. Grass seed production can vary 100 fold in response to inter-annual variation in summer precipitation.
2. Overwintering sparrow numbers vary greatly in response to variation in grass seed production. When seed production is low (less than 20 kg per hectare), sparrows consume upwards of 90% of all seeds produced. A 100 fold increase in seed production results in approximately a 10 fold increase in the number of overwintering sparrows and, in years of highest seed production, sparrows consume less than 10% of the seeds produced.
3. In years of high seed production sparrows consume fewer kinds of seeds, that is when seeds are abundant, they specialize on the few seed species that they handle most efficiently. Sparrows are more mobile in years of low seed production. They occupy a wider range of habitat types and they migrate further south when seed production is low.

4. Larger sparrows are more efficient at husking larger seeds and habitats with a wide range of seed sizes can support both large bodied species (eg. brown towhee) and small species, like chipping sparrow.
5. Different sparrow species avoid predators in different ways. Three predator avoidance strategies are used:
a) 'Retreat to Cover' Strategy: some species (e.g. towhees, white-crowned sparrows) always feed directly under or within a few meters of cover and always retreat to tree or shrub cover when attacked by a predator or otherwise disturbed.
b) 'Hide in Grass' Strategy: some species (e.g., grasshopper and Baird's sparrow) only feed in open spaces between dense clumps of grass; these tend to be very cryptic species that are reluctant to flush. When disturbed they fly low over the grasses and either drop back to the ground or retreat to nearby trees or shrubs.
c) 'Hide in Flock' Strategy: some species (e.g., longspurs) feed in large flocks far from tree and shrub cover and often in areas of very sparse cover; when disturbed they 'hide' in large, tightly knit flocks to avoid predation.

Of course, some species have flexible strategies and do not fit nicely into a single category. For example, Vesper's and savannah sparrows are intermediate, always retreating to cover when feeding near trees and shrubs but sometimes behaving more like grasshopper sparrows when far from cover.

As a result of different predator avoidance strategies, different sparrow species feed at different distances to cover. Species that characteristically feed far from cover are less abundant in grasslands with high shrub density and other species benefit from increased shrub cover. Maintaining a mix of areas that are shrub free and areas that have varying densities and distributions of shrubs and trees maximizes sparrow abundance and diversity.

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Presentations

Ecology of Montezuma quail in Southeast Arizona

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Many aspects of Montezuma quail (*Cyrtonix montezumae)* life history—especially population dynamics, range and habitat use—remained as knowledge gaps due to historical difficulties in capturing and monitoring marked individuals of this species. Our study overcame these difficulties and we were able to trap and monitor 55 individuals from 2009–2010 at the Appleton-Whittell Research Ranch in Elgin, Arizona. Techniques for trapping and monitoring included the use of trained pointing dogs, hoop nets, funnel traps, and forward-looking infrared (FLIR) cameras. We radio-tracked marked individuals and determined range size using the fixed kernel

estimator. In 2009 we determined the 95% utilization distribution (UD) to be 107.02 ± 96.54 ha and in 2010 the 95% UD was 21.92 ± 12.05 ha. We used the Kaplan-Meier staggered entry method to determine finite survival probabilities of marked individuals: these were 0.236 ± 0.128 for 2009 and 0.048 ± 0.037 for 2010. A wildfire in 2009 provided an opportunity to examine post-fire succession and habitat use. We observed roosting in fire-affected areas within 1 week post-fire and successful nesting in fire-affected areas within 3 months post-fire. Low survival and reduced 95% UD range in 2010 was attributed to strong El Niño conditions in the Pacific that brought a severe winter storm to the region.

Pedro Chavarria using radiotelemetry to find Montezuma Quail.

The Christmas Bird Count – Fun or Functional?

Linda Kennedy, Ph.D., Appleton-Whittell Research Ranch, Elgin, AZ.

The Christmas Bird Count grew from two separate cultural aspects of the late 1800s and early 1900s: side hunts, where teams of shooters spent Christmas Day competing against other teams to see who could kill the greatest number of birds, and fashion which included wearing the plumage of bright or beautiful birds. In two afternoons in the fashion district of New York, Frank Chapman, who founded what later became the Audubon magazine, observed 174 birds of 40 species worn as decorative apparel (Price 2004). The carnage was especially dire in the Everglades where plume hunters slaughtered egrets, herons, ibis, and other beautiful birds, often leaving nests of eggs or hatchlings unprotected. Audubon and the American Ornithologist's Union hired the first game warden, Guy Bradley, to protect nesting areas in the Everglades. Bradley was shot and killed by an egret hunter in 1905. Chapman and the fledgling Audubon Society urged that fashion shift from display of dead birds and demonstrated that counting birds instead of shooting them was a rewarding way to spend Christmas Day. In 1900 a Christmas Bird Count (CBC) included 27 individuals in 25 locations. Currently, more than 50,000 observers participate in 2000+ locations per year. The protocol for conducting a CBC has been standardized and the event takes place from mid-December through early January. Data are compiled by Audubon and the CBC is considered to be the longest running, geographically widespread survey of birds in the western hemisphere. The Appleton-Whittell Circle was sanctioned in 2006 thanks to the efforts of Robert (Bob) Whitcomb and Robert Weissler.

CBCs are a great opportunity to spend a day (or more) in the field observing birds – but they're more than that. The data are a rich source of information about avian populations and behavior. However, there are problems associated with these data – there is a great deal of variability between the number of participants, their skill levels, the number of hours spent in observation, and the types and amount of travel within each circle. In addition – what role is played by attractants such as bird feeders?

Many researchers have overcome the problems associated with the data collection protocol and have produced many publications based on the results of CBCs. For example, Dr. Carl Bock, formerly Research Director of the Research Ranch, has co-authored nineteen papers based on CBC data. More recently, Niven *et al.* (2009) used 40 years of CBC information to examine changes in range of 305 species. When linked with temperature data from the National Oceanic and Atmospheric Administration a pattern emerged. Although there were some exceptions, when all species were averaged together there was a northward shift of center of abundance of more than 30 miles in the past 40 years. During the same timeframe, average winter temperatures have increased.

So yes, the Christmas Bird Count is fun – but it's also functional! The combined efforts of many observers have provided a powerful tool for scientists.

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Hummingbirds

Susan Wethington, Executive Director of the Hummingbird Monitoring Network, shared some of the amazing information she has learned about these tiny avian dynamos.

Responses of Songbirds to Restoration of Shrub-invaded Grasslands

Bob Steidl, who spoke at the first Science on the Sonoita Plain, brought us up to date on his work with songbirds as they cope with changing habitat conditions.

Conservation of North America's Grassland Birds in the Chihuahuan Desert

Alberto Macìas-Duarte[1,2], Arvind Panjabi[1], Duane Pool[1], and Greg Levandoski[1]
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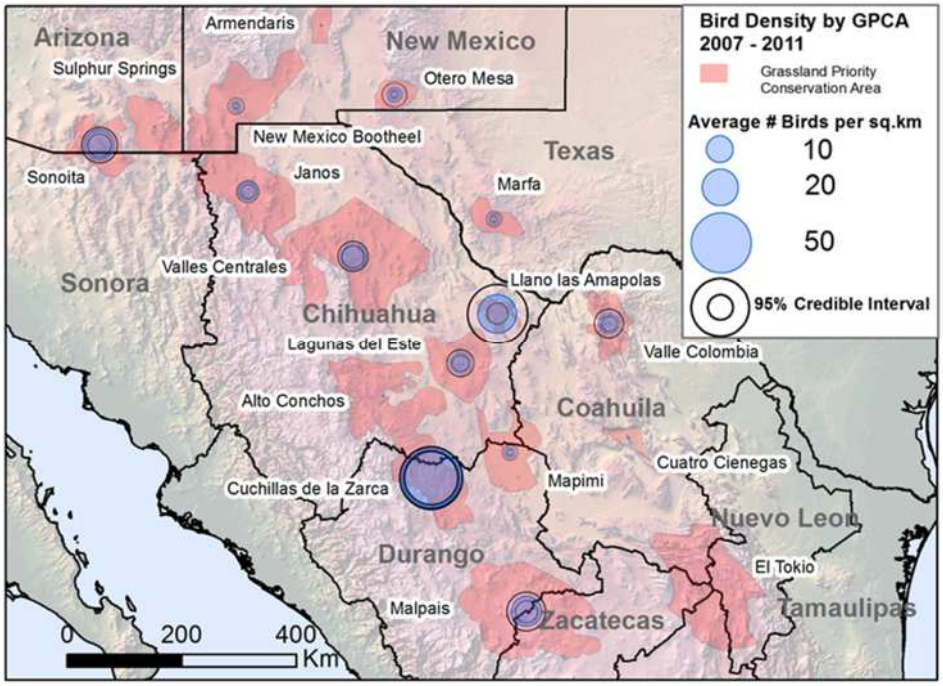
Many North American grassland bird species are undergoing steep, widespread, and long-term population declines, probably due to the continued habitat loss and degradation over much of their breeding ranges. Furthermore, the contribution of the threats that grassland birds face during the winter in these documented population declines, although hypothesized to be important, remains unknown. Therefore, information on wintering grassland bird distribution, abundance, and habitat use is urgently needed to guide strategic habitat conservation in the wintering grounds. Rocky Mountain Bird Observatory initiated in 2007 a first-ever, region-wide pilot survey to monitor wintering birds at 468 randomly-selected grassland sites in seven Chihuahuan Desert Grassland Priority Conservation Areas (GPCA) in northern Mexico. This effort has been expanded every year since then to eventually include 1,159 sampling locations in 16 GPCAs in northern Mexico, southeastern Arizona, southern New Mexico and western Texas in 2011. We surveyed birds through 1-km line transects at each sampling location with distance sampling to estimate bird density. We also characterized habitat structure using ocular estimates. These surveys generated data on habitat conditions and abundance of 50 grassland obligate or facultative species in 16 GPCAs, including 29 priority species of high regional or continental conservation interest. We used hierarchical modeling approach of distance sampling to estimate parameters for bird density models that account simultaneously for imperfect detection, the effect of habitat structure characteristics on density, and random spatio-temporal variation. We used the Bayesian estimation paradigm to obtain model parameters using Markov Chain Monte Carlo techniques in program WinBUGS. We obtained annual estimates of winter population density per species at each GPCA (Fig. 1A for the Baird's Sparrow), as well as model-based

inferences on the effect of six habitat structure variables on winter bird density (Fig. 1B for the Baird's Sparrow). Winter grassland bird communities throughout the Chihuahuan Desert are highly variable in species abundance and composition from winter to winter. Bird densities may change in orders of magnitude at the GPCA level and bird species may reach their maximum density at different GPCAs in different years. Therefore, we emphasize need to investigate the ultimate processes driving this high variability in winter bird abundance throughout the Chihuahuan Desert, highlighting the role of summer rainfall on food limitation. Chihuahuan Desert grasslands winter avifaunas are characterized by the dominance of few species including Chestnut-collared Longspur, Lark Bunting, Vesper Sparrow, Horned Lark, Brewer Sparrow, and Savannah Sparrow. A hierarchical cluster analysis of GPCAs based on bird species composition shows geographically consistent clusters of GPCAs suggesting a delineation of six conservation regions for grassland birds in Chihuahuan Desert: 1) Southern Sierra Madre Occidental Foothills, 2) Eastern Chihuahuan Desert; 3) Central Chihuahuan Desert, 4) Southern New Mexico, 5) Northern Sierra Madre Occidental Borderlands, and 6) Trans-Rio Grande. Analysis of biodiversity metrics (species richness and Shannon-Weaver diversity index) suggests that Cuchillas de la Zarca in northern Durango, Janos in nortwestern Chihuahua, and Malpais in Southeastern Durango harbor diverse winter bird communities and should be effectively protected. Information on bird abundance and distribution generated by this project is providing valuable information to generate demographic projections and habitat models (such as those shown in Fig. 1B) during the winter season. These tools will allow agencies and land managers to set and achieve target population levels of grassland bird species through habitat management to ensure their long-term conservation.



(A) Mean winter density of the Baird's Sparrow

(B) Habitat relationships of the Baird's Sparrow.

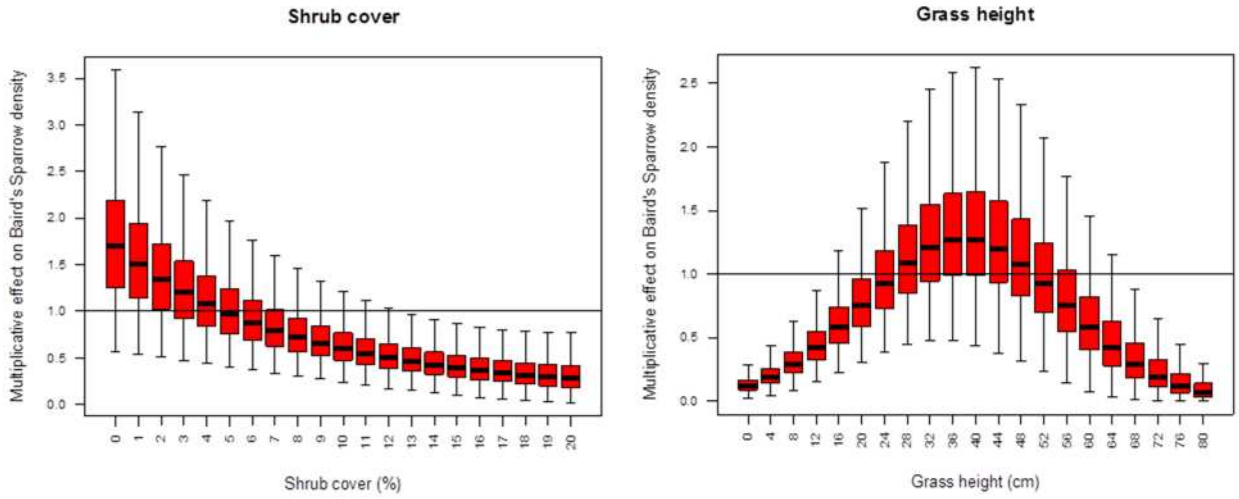


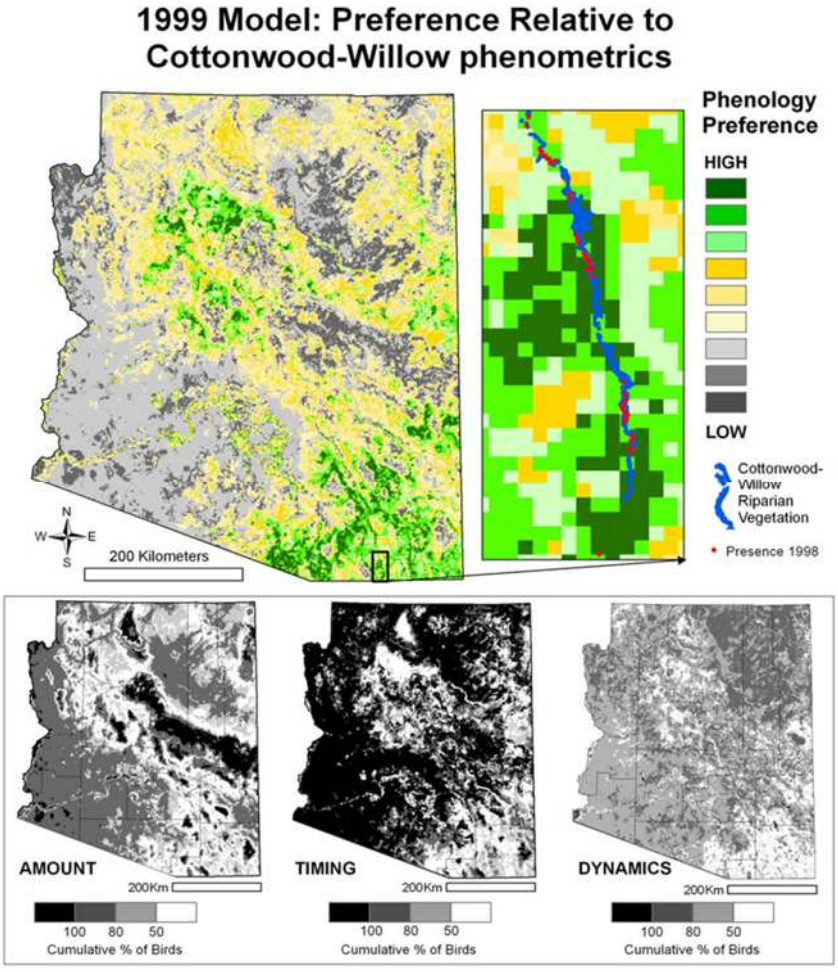
Fig. 1. (A) Mean winter density of Baird's Sparrows in Grassland Priority Conservation Areas through the Chihuahuan Desert from 2007-2011. (B) Effect of habitat structure attributes (shrub cover and grass height) on Baird's Sparrow winter density; each whiskered box (showing the 2.5, 25, 50, 75, and 97.5th percentiles) corresponds to the posterior distribution of the effect of the habitat variable at the specified level.

Yellow-billed Cuckoo Habitat Selection in Arizona is influenced by Monsoon-related Riparian Phenology

Cynthia S.A.Wallace, and Miguel Villarreal, Western Geographic Science Center-USGS, Tucson, AZ; Charles Van Riper III, Southwest Biological Science Center-USGS, Tucson, AZ

The yellow-billed cuckoo (*Coccycus americanus occidentalis*) is a neo-tropical migrant bird that travels from Central and South America into the southwestern United States during the summer to nest. In the western United States, favored riparian forest and woodland nesting habitat of this threatened species has declined over the past century, due primarily to human activities and associated water demands. In this study, we map yellow-billed cuckoo habitat in the state of Arizona using the temporal greenness dynamics of the landscape, or the landscape phenology. Landscape phenometrics were derived from Advanced Very High Resolution Radiometer (AVHRR) 1 kilometer resolution bi-weekly time-composite satellite Normalized Difference Vegetation Index (NDVI) composite data for 1998 and

1999 using Fourier harmonic analysis to analyze the waveform of the annual NDVI profile at each pixel. Field data were obtained from three different groups who surveyed yellow-billed cuckoo in 1998: Northern Arizona University, the Arizona Game and Fish Department, and the U.S. Geological Survey. To create the models, we coupled the 1998 field data of cuckoo presence or absence and points sampling riparian and cottonwood-willow vegetation types with the 1998 satellite phenometrics. Models were tested using field and satellite data collected in 1999. Statistical tests reveal yellow-billed cuckoo occupy locations within their preferred riparian habitat that exhibit peak greenness after the start of the summer monsoon and are overall significantly more green and more dynamic than "average" habitat. These results show that habitat suitability and selection is not only determined by the physical components of habitat, such as topography, species mix, structure and density, but is also determined by the dynamics of the landscape, which includes the vegetation response to climate. Identification of preferred phenotypes within recognized habitat areas can be used to refine habitat models, inform habitat response to climate change, and suggest adaptation strategies.



UPDATES

Endangered Desert Pupfish

One of the highlights of the 2011 Science on the Sonoita Plain symposium was the release of endangered Desert Pupfish into the pond near the headquarters of the Research Ranch. This year, Doug Duncan of the U.S. Fish and Wildlife Service returned and conducted a survey of the population. His report and photos follow.

TRIP NOTES

Date: 9 JUNE 2012
Purpose: Desert pupfish survey @ Science on the Sonoita Plain
Location: Appleton-Whittell Research Ranch
Personnel: Doug Duncan

Set four (4) Gee metal minnow traps in four corners of the pond at 1040-1045 hrs. All baited with dog food. Traps were set for about two hours each: checked at 1240-1255 hrs. Size class break for adult and juvenile was 20mm. Many fish captured were near 20mm. Just before pulling traps, I estimated at least four dozen pupfish, mainly juveniles, were still swimming free outside the traps. 294 pupfish were captured: 146 adults, 148 juveniles. All fish appeared healthy. The catch per unit effort (fish/trap hour) was 37. Minimum number in traps and swimming free was 342. This pond is probably at capacity for the amount of water and vegetation present. It is a good site, with controlled access, and opportunities for native fish education.

Desert pupfish (*Cyprinodon macularius*) captured at ARR pond 9 June 2012.

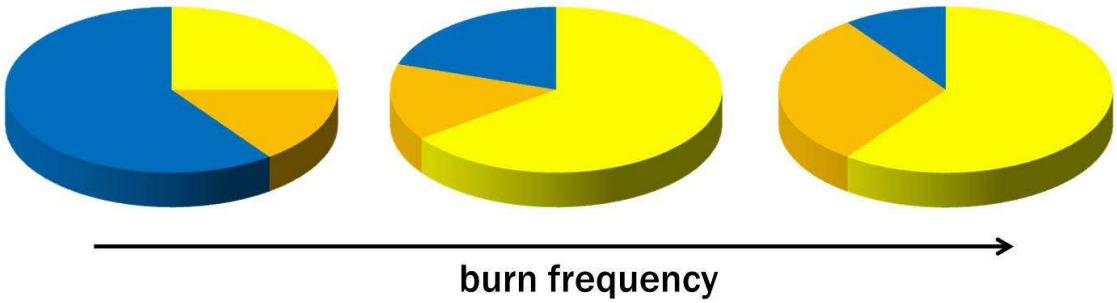
Trap location	Adult	juvenile	A/J	TOTAL	CPUE
NE corner	3	11	27/100	14	7
NW	37	43	86/100	80	40
SW	49	55	89/100	104	52
SE	57	39	146/100	96	48
TOTAL	146	148	99/100	294	37

Go Big, Go Far, or Go Home: A Tree Lizard's Guide to Surviving Environmental Change

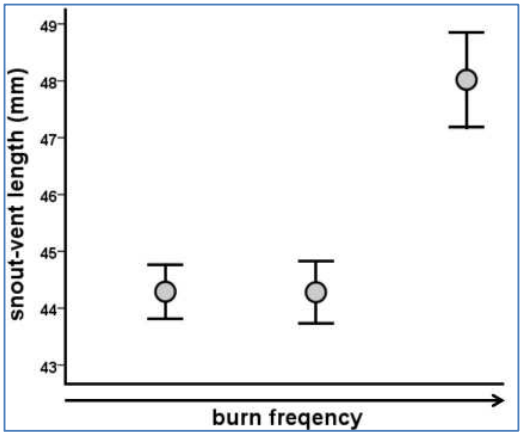
Matt Lattanzio and **Kortney Jaworski**,
University of Ohio

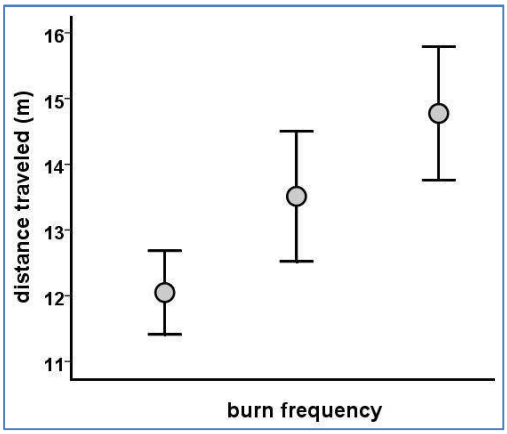
For many ectotherms, the option to track favorable habitats after a disturbance is limited, forcing them to attempt to 'make the best of a bad situation.' This compensatory strategy can be associated with morphological, behavioral, and dietary shifts as organisms attempt to maintain stable or growing populations in disturbed regions. Here, we discussed some of the broader trends of my research at the ranch investigating these responses and their links to population persistence in ornate tree lizards (*Urosaurus ornatus*). We highlight three potential responses the lizards appear to be exhibiting: go big, go far, or go home. In regions burned more frequently, lizards are on average 1-2 cm (10-20 mm) larger in adult body size than their conspecifics in unaltered or less-burned areas. In addition, these lizards also exhibit greater stamina (longer endurance on an experimental track) compared to

those same other populations. Finally, tree lizard populations are comprised of males exhibiting different throat colors: yellow, blue, or orange.



These colors correspond to behavioral (levels of aggression/territoriality) variation as well. In more burned areas, there appears to be a near-total loss of the blue morph, a type of male that appears to be only weakly territorial. It thus appears that in more burned regions, this morph is lost ("goes home") and supplanted by a greater frequency of the more aggressive (yellow) or nomadic (orange) morphs which may be better adapted to the more open, grassier habitats characterizing burned regions. Our results shed light on the factors that shape population persistence, and emphasize that the connections between disturbance events (short-term) and population extinction (long-term) may not be as linear as generally modeled.





More Lizard Stuff: Answering Questions with Bunchgrass Lizards

Ivan Monagan and Dr. Christian d'Orgeix, Virginia State University

Bergmann's Rule (1847) predicts that species will be larger at increasing latitude or higher elevation, both of which are cooler in temperature. Individuals of more northerly latitudes or higher elevation are presumed to be larger because having a larger body results in having less surface area exposed compared to the mass of the animal. Larger size then would help an animal conserve heat in cooler climates. There is broad support for Bergmann's rule in endoderms (warm-blood animals). However, in ectotherms (cold-blooded animals such as reptiles) the application of the rule is controversial because some species seem to follow Bergmann's rule and others don't.

We are using Slevin's Bunchgrass lizard to test this idea. The bunchgrass lizard is somewhat unique in occurring in the lower elevation cienega grasslands such as Audubon's Appleton-Whittell Research Ranch and on the tops of Sky Island mountains in Arizona enabling us to measure lizard size in warmer lowland grasslands and compare it with the size of higher elevation mountain populations. We are finding that bunchgrass lizards show the opposite pattern of what is predicted by Bergmann's Rule - the largest lizards are in the warmer, lowland grasslands and the smallest at cooler, higher mountaintop elevations. The most probable explanation for this "converse of Bergmann's Rule" is that because lizards depend on the warmth of the sun or substrate to gain heat, it pays to be smaller higher up where temperatures are cooler and smaller size enables the animals to heat up more rapidly. Larger lizards might spend too much time trying to gain enough heat to have time to find food or carry out their normal daily activities.

In addition to the research on Bergmann's Rule we are trying to determine if bunchgrass lizards are genetically isolated on Sky Island Mountains or if they are using the grasslands as genetic bridges between mountain populations. We are also tracking the population numbers of the Appleton-Whittell bunchgrass lizards, which almost disappeared about 15 years ago and appear to be surviving in very low numbers. Lastly, we are conducting population surveys on this relatively rare lizard to determine if higher elevation populations are more adversely influenced by global warming.

Compiling Aerial Photography on Cienega Creek and Sonoita Plain

Matthew King[1], Ron Tiller[2], Elizabeth Taddiken, and Gita Bodner[2]

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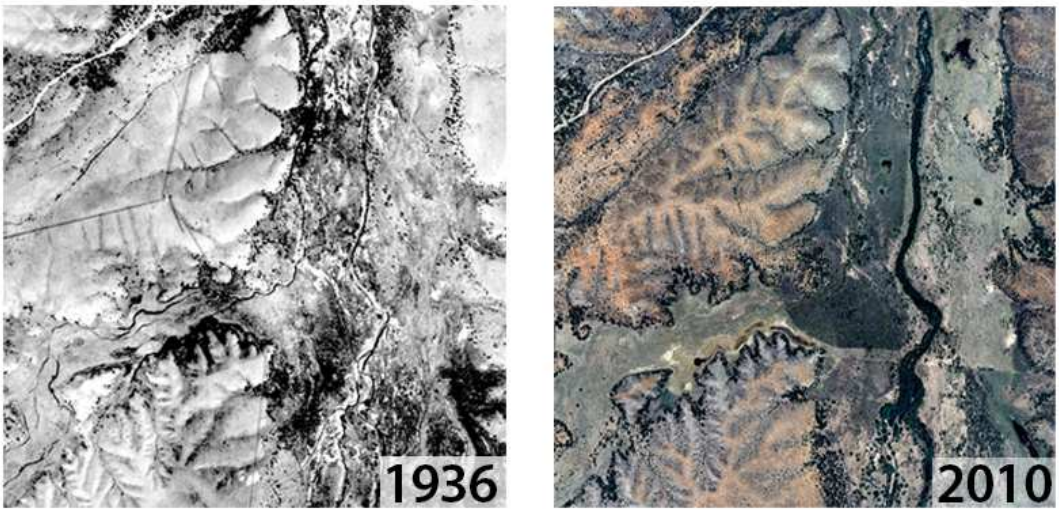
The main scope of this project was to compile historical imagery for the Cienega Creek watershed, encompassing the Cienega Creek Basin and Sonoita Plain. Aerial photography captured in the 1930s by the Fairchild Aerial Surveys company provides the oldest record we have for the study area. Continuing from this point we sought out other historical imagery from various sources, including archives held at the Bureau of Land Management, Pima Association of Governments, Arizona State University, the Audubon Appleton-Whittell Research Ranch, online repositories managed by the US Geological Service, and private companies. Imagery sets with adequate coverage of the study area were acquired either as digital copies, or as hard copies that were subsequently digitized. We assembled this imagery into a singular database, which contains imagery from almost every decade since the 1930s (1940s imagery could not be found).



In an effort to maximize the utility of this imagery dataset, we partially georeferenced (placed in geographic space) photographs in each set around Cienega Creek. This allows users of the database to manipulate and view the imagery in a GIS, and to see an example of the time series this database can provide to investigate land cover change. Additionally, we utilized the "Mosaic Raster Dataset" in ArcGIS which provides a near seamless view of the dataset and allows quick rendering of imagery at different scales. There remains a vast amount of imagery to be analyzed and georeferenced, but the work completed in this project should illustrate the value of this historical imagery in documenting and interpreting landscape changes in this ecologically important area of the state. For example, from the small amount of imagery we georeferenced we were able to begin to interpret the following changes: agricultural development and abandonment, stream diversion and realignment, land use impacts on cienega wetlands, woody plant encroachment, recolonization of Sacaton grasslands, and the formation of a Cottonwood-Willow riparian forest.

Work on this project was carried out by staff at Desert Botanical Garden and The Nature Conservancy, with funding provided by the National Fish and Wildlife Foundation. The database, about 400 GB, is now available by request to either DBG or TNC who will be housing archival copies. Contributions in the form of imagery or further database development are welcome and encouraged of recipients of the database.

Mapping and Characterizing Cienegas at Las Ciengas National Conservation Area

Andrew Salywon[1], Ronald Tiller[2], Matthew King[1] and Kevin Hultine[1]

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Cienegas are one of the rarest and most endangered habitats in southern Arizona. Historic alteration and destruction has eliminated/reduced the extent of approximately 95 percent of cienegas in the region. However, cienegas are rather poorly studied and quantitative data regarding the area and

location of historic and even current cienegas is lacking. Therefore, we have initiated a study to map and characterize the cienegas at Las Cienegas National Conservation Area (LCNCA). Our objectives are fourfold:

The first objective is to provide a geo-referenced GIS layer with the outlines of the cienegas. The shape files of the outlines of the cienegas and wetlands will be sub-foot accurate and generated from walking the perimeters of these areas. The resulting information-rich GIS layer will be the first georeferenced electronic map of the cienegas. This layer will provide a baseline foundation for informed monitoring and study of the cienegas and wetlands and will benefit many diverse parties, including hydrologists and ecologists, working from the species-level to the landscape level (e.g., Fig. 1). For example, to make quantitative assessments and predictions of trajectories of land cover change, the area of the present day cienegas can be compared to the areas occupied by cienegas from the earliest synoptic depiction of the vegetation for LCNCA available (Fairchild imagery from 1936).

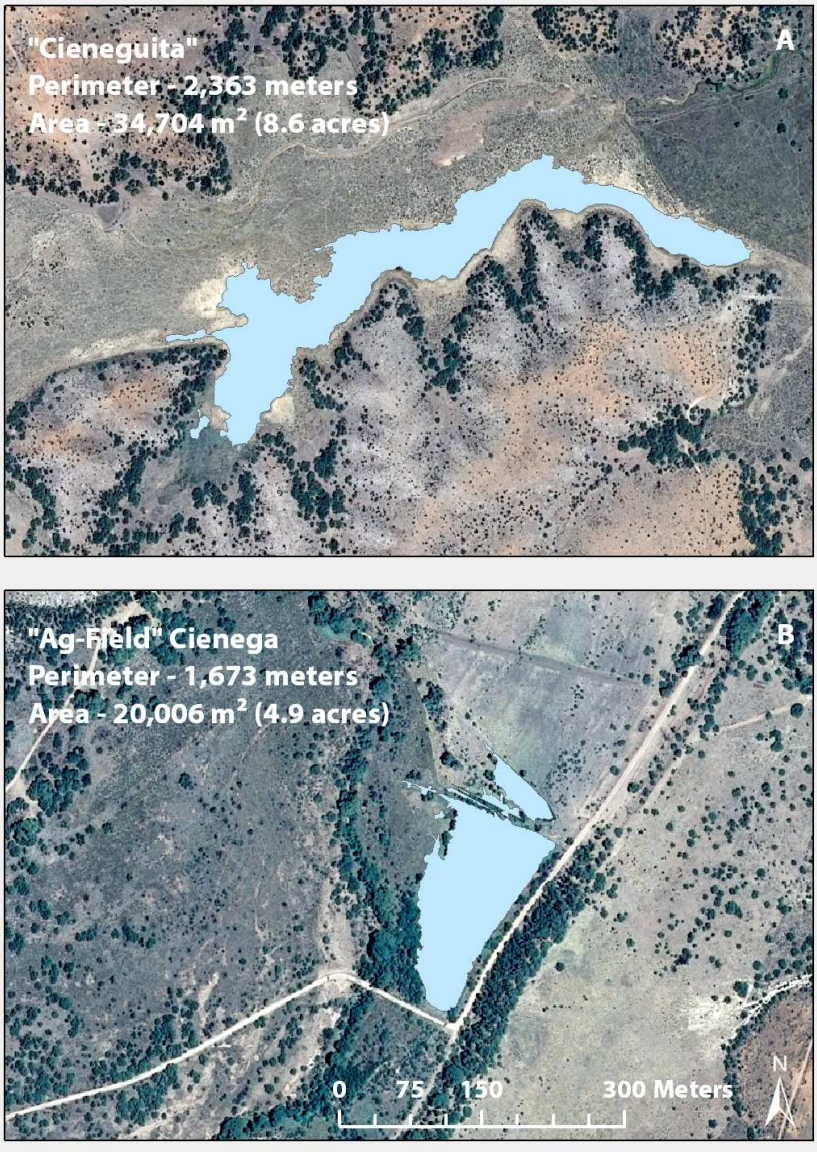
The second objective is to provide a sub-foot accurate geo-referenced GIS layer of the pre-existing wells and piezometers on LCNCA. This layer will provide a baseline foundation for informed monitoring and study of the cienegas and will benefit many diverse parties, including hydrologists and ecologists, working from the species-level to the landscape level.

The third objective is to provide a geo-referenced GIS layered groundwater map of the cienegas to the BLM and stakeholders. The contoured groundwater map will illustrate the seasonal groundwater depth below surface. Groundwater depth will be measured four times during the year (March, June, September, November) from pre-existing wells located throughout the watershed. This GIS layer will provide the framework for hydrologists to study the linkages between groundwater flow with the seasonal timing and amount of precipitation. Likewise, the groundwater map will be layered with a geo-referenced plant distribution map that will allow plant ecologists to identify patterns of plant:groundwater relationships.

The fourth objective is to provide a comprehensive analysis of the stable isotopic concentrations and nutrient ion concentrations in groundwater, surface waters and on-site precipitation. The stable isotope (d^2H, $d^{18}O$) composition in water can be linked to water source such that winter precipitation in southern Arizona is generally isotopically distinguishable from summer monsoonal precipitation. By taking advantage of these isotopic differences in precipitation, we can identify sources of groundwater recharge and surface runoff. We will also analyze the nutrient ion (NO_3, PO_4) concentration of groundwater and surface waters so that hydrologists can assess the impacts of anthropogenic land use on water quality. Specifically, these data will allow stakeholders to gauge the impacts of grazing or another land use activities on nutrient loading into cienegas, streams and wetlands. High nutrient concentrations could facilitate the recruitment and productivity of invasive plant

species, lead to stream eutrophication, and threaten native fish and other aquatic species. Measurements will be conducted four times during the year (March, June, September, November) from pre-existing wells, and surface waters located throughout the watershed. A GIS layered map of water isotopic composition and nutrient ion concentrations will be developed and distributed to the BLM and stakeholders.

Fig. 1. Examples of GIS shapefiles for Cieneguita (A) and the Ag-Field (B) generated from walking the perimeter of cienegas, in fall 2011, with sub-foot accurate GPS unit layered over aerial photography.



Scientific Posters

Herpetofauna at the Appleton-Whittell Research Ranch

Roger C. Cogan, Conservation Coordinator, Appleton-Whittell Research Ranch of the National Audubon Society, Elgin, AZ

A rich diversity of amphibian and reptile species occurs at the Appleton-Whittell Research Ranch, an 8000-acre sanctuary for native biota and research facility in the semi-arid grasslands of southeastern Arizona created in 1969 managed by the National Audubon Society since 1980. Nine species of amphibians and forty-two species of reptiles have been identified by staff and researchers within the preserve. Efforts are underway to document the current richness of the herpetofauna. Recent surveys in 2010 - 2012 have confirmed continued presence of 26 species. As part of that inventory effort, we located seven overwintering sites of rattlesnakes. Our challenge into the future is to adaptively manage the Research Ranch to provide sanctuary to the appropriate plant and animal species under a likely changing climate.

Since cattle were removed in the 1960s collecting efforts over several decades by numerous researchers have identified nine amphibian and forty-two reptile species representing twenty nine genera within the preserve. There have been ongoing investigations with several individual species. However the herpetofauna as a whole has not been assessed. Efforts are currently ongoing to locate and document the continued existence or absence of all herp species that occur within the Research Ranch boundaries.

The Research Ranch management area covering eight thousand acres are primarily semi-arid grassland. Searches for amphibians and reptiles are conducted when conditions are appropriate for herp surface activity. However most encounters occur during times when staff and researchers are traveling or working in the field. When sightings occur they are documented with photographs whenever possible and recorded. Unique and rare sightings are recorded with GPS for future reference.

During the history of the Research Ranch there have been several surveys for herps and individual species have been investigated. This is the first attempt to monitor and document presence or absence of all herp species previously identified at the Preserve. Since 2010 surveys have confirmed that twenty six species are still present at the Research Ranch.

Greater Short-horned Lizard (*Phrynosoma hernandesi*)

Herpetofauna Identified at the Research Ranch

*Continued presence visually observed and documented with photographs 2010-2012.

Amphibians: nine species, of seven genera

*Red-spotted Toad	(*Anaxyrus punctatus)*
*Sonoran Desert Toad	*(Ollotis alvarius*)
Couch's Spadefoot Toad	(Scaphiopus couchii)
*Chihuahua Spadefoot Toad	*(Spea multiplicata stagnalis)*
*Canyon Treefrog	*(Hyla arenicolor)*
Tiger Salamander	(*Ambystoma mavortium* ssp.)
Chiricahua Leopard Frog	*(Lithobates chiricahuensis)* Believed to be extirpated
Lowland leopard Frog	(*Lithobates yavapaiensis*) Believed to be extirpated
*American Bullfrog	(*Lithobates catesbeiana*) Invasive non-native

Lizards: nineteen species, of eight genera

Arizona Striped Whiptail	(*Aspidoscelis arizonae*)
Canyon Spotted Whiptail	(*Aspidoscelis burti stictogrammus*)
Chihuahuan Spotted Whiptail	(*Aspidoscelis exsanguis*)
Gila Spotted Whiptail	(*Aspidoscelis flagellicaudus*)
*Sonoran Spotted Whiptail	(*Aspidoscelis sonorae*)
Sonoran Tiger Whiptail	(*Aspidoscelis tigris punctilineatus*)

*Desert Grassland Whiptail (*Aspidoscelis uniparens*)
Eastern Collared Lizard (*Crotaphytus collaris)*
*Madrean Alligator Lizard (*Elgaria kingii nobilis)*
Mountain Skink (*Plestiodon callicephalus)*
Great Plains Skink (*Plestiodon obsoletus)*
*Chihuahuan Earless Lizard (*Holbrookia maculata flavilenta*)
*Greater Short-horned Lizard (*Phrynosoma hernandesi)*
Round-tailed Horned Lizard (*Phrynosoma modestum*)
Regal Horned Lizard (*Phrynosoma solare)*
*Clark's Spiny Lizard (*Sceloporus clarkii*)
*Slevin's Bunchgrass Lizard (*Sceloporus slevini)*
*Southwestern Fence Lizard (*Sceloporus cowlesi)*
*Ornate Tree Lizard (*Urosaurus ornatus linearis)*

Snakes: Twenty species, of twelve genera
* Western Diamondback Rattlesnake (*Crotalus atrox)*
* Mojave Rattlesnake (*Crotalus scutulatus)*
* Rock Rattlesnake (*Crotalus lepidus*)
* Black-tailed Rattlesnake (*Crotalus molossus)*
* Regal Ringneck Snake *(Diadophis punctatus regalis)*
Chihuahuan Hook-nosed Snake (*Gyalopion canum*)
Mexican Hognose Snake (*Heterodon nasicus kennerlyi)*
Spotted Nightsnake (*Hypsiglena torquata ochrorhynchus*)
Western Black Kingsnake (*Lampropeltis getula nigrita*)
Desert King Snake (*Lampropeltis g. splendida*)
*Arizona Mountain Kingsnake (*Lampropeltis p. pyromelana*)
*Sonoran Whipsnake (*Masticophis bilineatus*)
Sonoran Coachwhip (*Masticophis flagellum cingulum*)
Sonoran Coral Snake (*Micruroides e. euryxanthus*)
*Sonoran Gopher Snake (*Pituophis catenifer affinis*)
Western Patchnose Snake (*Salvadora deserticola*)
*Eastern Patchnose Snake (*Salvadora g. grahamiae*)
*Western Groundsnake (*Sonora semiannulata*)
*Western Black-necked Garter Snake (*Thamnophis c. cyrtopsis*)
Mexican Garter Snake (*Thamnophis eques megalops*)
*Checkered Garter Snake (*Thamnophis m. marcianus*)

Turtles: two species, of two genera
*Sonoran Mud Turtle (*Kinosternon sonoriense*)
*Desert Box Turtle (*Terrapene ornate luteola*)

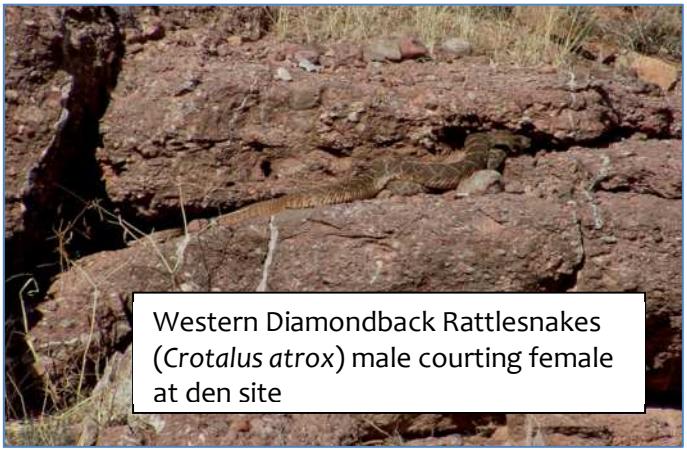
References from previous species list:
June – August 1982 compiled by Mark Dodero and John Spengler
May 19 1987 updated species list author unknown
October 23, 2002 updated list by Hobart M. Smith and David Chiszar University of Colorado
October 2011 updated list, Roger Cogan, Appleton-Whittell Research Ranch

Rattlesnake Wintering Sites at the Appleton-Whittell Research Ranch

Roger C. Cogan, Conservation Coordinator, Appleton-Whittell Research Ranch of the National Audubon Society, Elgin, AZ

The Research Ranch is an 8000 acre sanctuary and research facility in the semi-arid grasslands of southeastern Arizona managed by the National Audubon Society. At the Research Ranch we work to protect native species and the natural systems that occur both on the preserve and the surrounding area. Snakes are an integral element within all of the habitats where they are found. Snakes not only help maintain the fitness of their prey but they themselves are food for a wide variety of predators. They are a vital part of the landscape at all times of the year, yet little is known about the habitat requirements necessary for successful overwintering. Four rattlesnake species are known to occur at the Research Ranch; the Western Diamondback (*Crotalus atrox*), Black-tailed (*Crotalus molossus*), Rock (*Crotalus lepidus*) and the Mohave rattlesnake (*Crotalus scutulatus*).

During the months of February, March and April 2011-12, a survey for potential rattlesnake wintering sites was conducted when climate conditions are optimal for snakes to exit their den sites for brief periods. Searches were conducted whenever time permitted or when weather conditions seemed most likely to expose snakes at the surface. Confirmed den sites are photographed and georeferenced and, if possible, the snakes are photographed for vouchering.



Western Diamondback Rattlesnakes (*Crotalus atrox*) male courting female at den site

Within the Research Ranch locations of biological diversity are of special concern. Rattlesnakes are the largest reptilian predators that occur here. They are a vital component of the landscape and their continued existence is necessary. Little is known of the locations at the Ranch for rattlesnakes to survive winter conditions. In 2011-12 surveys were conducted to locate wintering sites. While the locations found are not the only sites available, they are preferred sites. Methods and Results: During the months of February, March and April 2011-12, surveys for potential rattlesnake wintering sites were conducted. This search was conducted whenever time permitted or when weather conditions seemed most likely to expose snakes at the surface. Confirmed den sites are photographed and georeferenced and, if possible, the snakes are photographed for vouchering.

Seven sites have thus far been identified and located. These locations are occupied by Western Diamondback Rattlesnakes (*Crotalus atrox*) and Black-tailed Rattlesnakes (*Crotalus molossus*); these sites are also wintering sites to Sonoran Gopher snakes (*Pituophis catenifer affinis*) and Sonoran Whipsnakes *(Masticophis bilineatus).* Rock rattlesnake (*Crotalus lepidus*) and Mohave rattlesnake (*Crotalus scutulatus*) wintering sites currently have not been located. Efforts are underway to locate their preferred wintering sites.

Biodiversity Database at the Appleton-Whittell Research Ranch

Virginia Dean*, volunteer, Appleton-Whittell Research Ranch of the National Audubon Society, Elgin, AZ

The Appleton-Whittell Research Ranch provides the location, resources, and opportunity for natural-history research projects in ungrazed, unimproved grasslands of southeastern Arizona. At ranch headquarters, research since 1968 is archived as hard-copy pages of published and unpublished documents, conference posters, electronic files of data and photographs, specimen collections, and species checklists. A recent addition to the archiving methods is an Excel© database of all plants or animals that have been documented on the Research Ranch. Each record includes several fields that are filled in whenever the information is available. These include order, family, genus, and species names; date of the sighting; location by GPS, landmark, or local place-name; type of habitat; life stage of the specimen; names and titles of the observer and species identifier; observed associated species and relationships; and photographs. A comment column or additional separate columns contain other interesting observed data, e.g., weather conditions, time of day, activity, health, size, color, unique attributes. The database consolidates local historical data that can be updated and used by future researchers in their reports.

So far we have included information on:

589 species of vascular plants
237 species of birds
9 species of amphibians
41 species of reptiles
42 species of grasshoppers
104 species of butterflies, moths or skippers
46 species of mammal

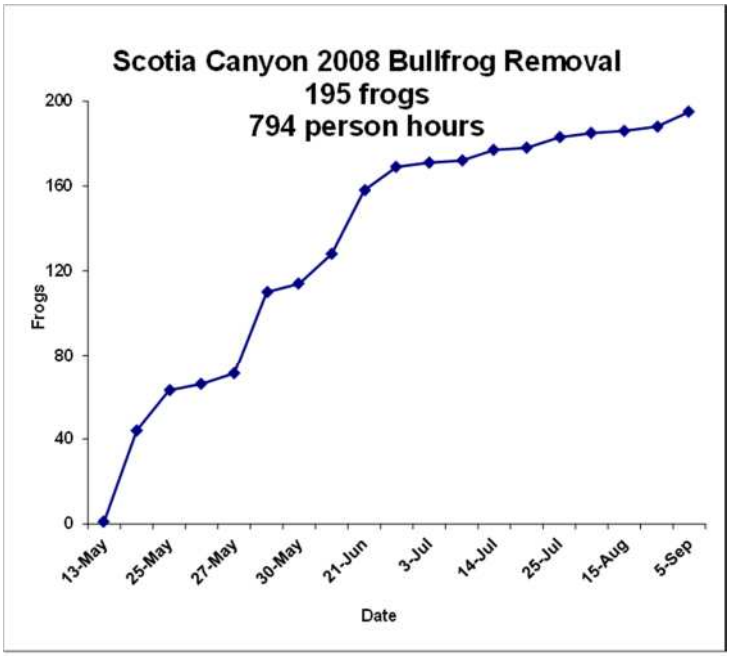
*Virginia passed away in April, 2012 after a courageous bout with cancer. She had volunteered at the Research Ranch for about a year and she worked on many projects. This biodiversity database was one that she had initiated and she spent many hours poring over reports and publications. It will be a continuing legacy as we add information to her baseline. – Linda Kennedy, Director

Reestablishment and protection of a Chiricahua leopard frog population in Scotia Canyon, Huachuca mountains, Arizona

Coronado National Forest photo.

Glenn P. Frederick,[1,4] Brooke S. Gebow,[2] and Thomas R. Jones[3]
[1]USDA Forest Service, Coronado National Forest, Sierra Vista Ranger District, 5990 S. Highway 92, Hereford, AZ 85615; [2]The Nature Conservancy, 27 Ramsey Canyon Road, Hereford, AZ 85615; [3]Arizona Game and Fish Department, 5000 W. Carefree Hwy, Phoenix, AZ 85086; [4]current address: Bureau of Land Management, 333 SW 1st Ave., Portland, OR 97204

Bullfrogs are significant impediments to recovery of native aquatic amphibians and reptiles in riparian systems in the American Southwest. Until recently, bullfrog control across landscapes with many stock tanks was considered unlikely to succeed. The Scotia Canyon project began in 2007 with breaching impoundments to restore a free-flowing stream and improve habitat for native aquatic species in the Huachuca Mountains. In 2008, the Coronado National Forest launched a multi-year, multi-



Cumulative capture effort for bullfrogs in Scotia Canyon and adjacent sites in 2008.

partner effort to eliminate bullfrogs within a 113 km2 area centered on Scotia Canyon. We eliminated all bullfrogs in Scotia Canyon and reestablished Chiricahua leopard frogs. Bullfrogs were removed at 10 stock tanks and along 3.7 km of stream within 9.7 km (6 miles) of Scotia Canyon. We focused control efforts at perennial sites and at 52 ha Parker Canyon Lake. During summer monsoon season we found adult bullfrogs in the Cave Canyon watershed traveling to headwaters with direct connections to Scotia Canyon. Bullfrogs reinvaded some stock tanks but not Scotia Canyon, where leopard frogs continue to persist.

The Forest Service in cooperation with the livestock grazing permittee has developed plans to manage stock tanks to disrupt bullfrog dispersal and control their reproduction. How to simultaneously maintain multiple stock tanks for livestock and native wildlife without perpetuating invasive species is a management challenge that is likely to increase in complexity with climate change. Cooperation among the Coronado National Forest, Arizona Game and Fish Department, The Nature Conservancy, US Fish & Wildlife Service, Fort Huachuca, Sky Island Alliance, and private landowners is a key component of this project's success to date.

Native leopard frogs have not been seen in Scotia Canyon since 1981. We reintroduced almost 250 Chiricahua leopard frog tadpoles into Peterson Ranch Pond October 13, 2009, and then the population was augmented with about 250 more on August 26, 2010. Reproduction was confirmed in 2010 and 2011.

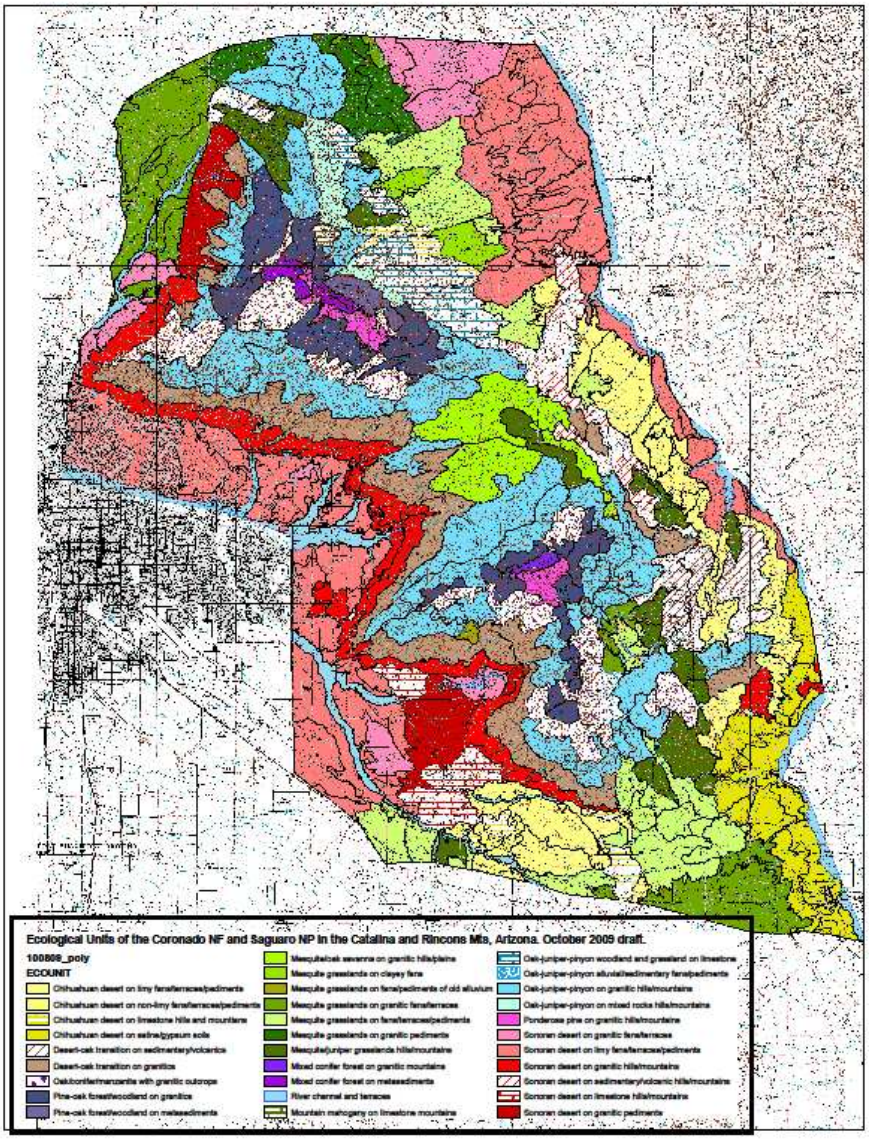
FireScape: A Program for Whole-Mountain Fire Management in the Sky Island Region

Brooke Gebow,[1,2] Donald A. Falk,[3] Christopher Stetson,[2] and Corrine Dolan[3]

[1]The Nature Conservancy, Southeastern Arizona Preserves, 27 Ramsey Canyon Road, Hereford AZ 85615. bgebow@tnc.org; [2]Coronado National Forest, 300 W. Congress Street, Tucson AZ 85701. chstetson@fs.fed.us; [3]School of Natural Resources and the Environment, Biological Sciences East, University of Arizona, Tucson AZ 85721. dafalk@email.arizona.edu; cdolan@ag.arizona.edu.

The Coronado National Forest's (CNF) FireScape program works to remove barriers to fire playing its natural role on the landscape. A long-term goal is creating landscapes that are able to survive wildfire with biodiversity intact, especially important in the face of a drier, hotter Southwest. The FireScape team is nurturing multiple efforts around the Sky Islands—no two projects are alike, but those underway share an approach that includes multiple jurisdictions, investigations by University of Arizona scientists, public engagement, assessing treatment need at the whole-mountain scale, and creatively removing implementation barriers when funding is scarce. Projects begin with cross-jurisdiction ecological mapping, since

neighboring agency lands rarely have been mapped at the same scales using the same kinds of units. Clearance for treatments in designated Wilderness is a need across all projects. The FireScape team has completed a fuels map and an analysis of departure from reference condition for southeastern Arizona that covers the CNF and partner lands. Partners have worked together to update Landfire data for this 14 million-acre area. These products provide inputs for fire behavior and effects analyses to support decision making and outreach. The Huachuca FireScape covers much of the Sonoita Valley south of Highway 82, and compliance for prescribed fire, thinning, and mastication treatments was completed in 2010. Availability of funding and narrow windows for safe prescribed fire during the prolonged drought remain obstacles. Catalina-Rincon, Chiricahua (Chiricahuas, Dos Cabezas, Dragoons), and Galiuro are the other multi-party projects underway that cover over 1 million acres of the Sky Island region. The website www.azfirescape.org is a work in progress that displays project information, including maps, reports, and vegetation and fuels data.



Catalina-Rincon Ecological Unit map is derived from underlying Landtype Association layer developed for this project. Find at azfirescape.org.

2011 Horseshoe 2 fire in the Chiricahua Mountains emphasizes rather than eliminates need for mountain-wide fire management. Fuels have been remapped based on burn severity data. The size of recent fires points out the need to plan for treatments at large scale through efforts like FireScape. Coronado National Forest photo.

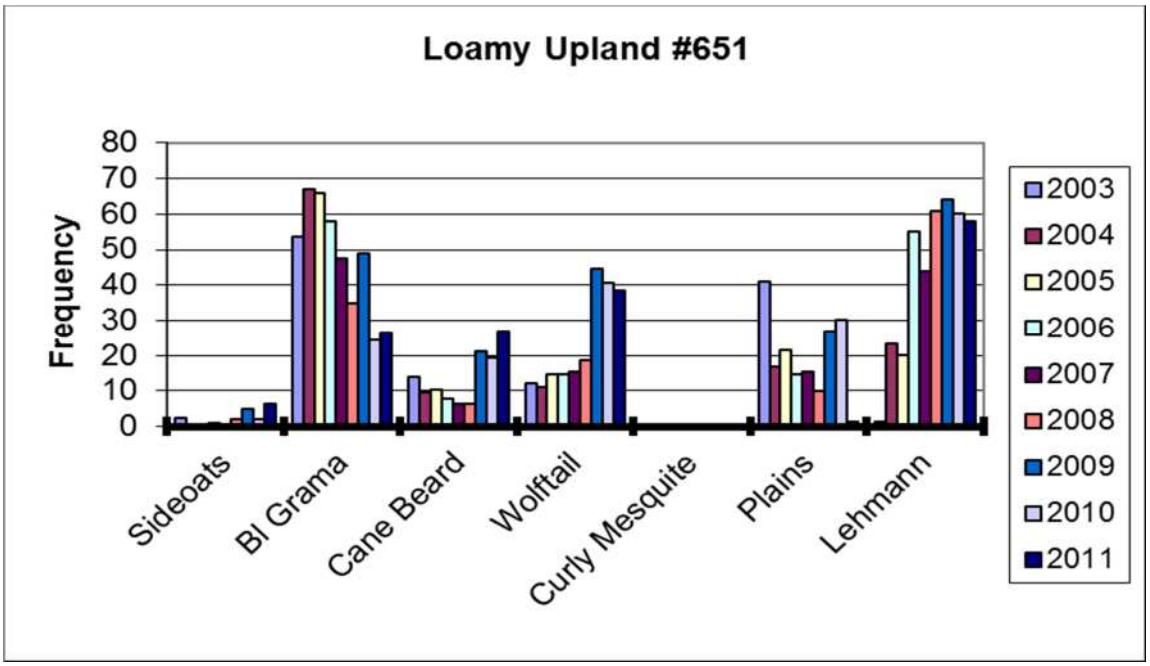
Vegetation Monitoring on an 8000 acre Exclosure

Linda J. Kennedy, Appleton-Whittell Research Ranch of the National Audubon Society, Elgin, AZ and Daniel G. Robinett, Robinett Rangeland Resources, Elgin, AZ.

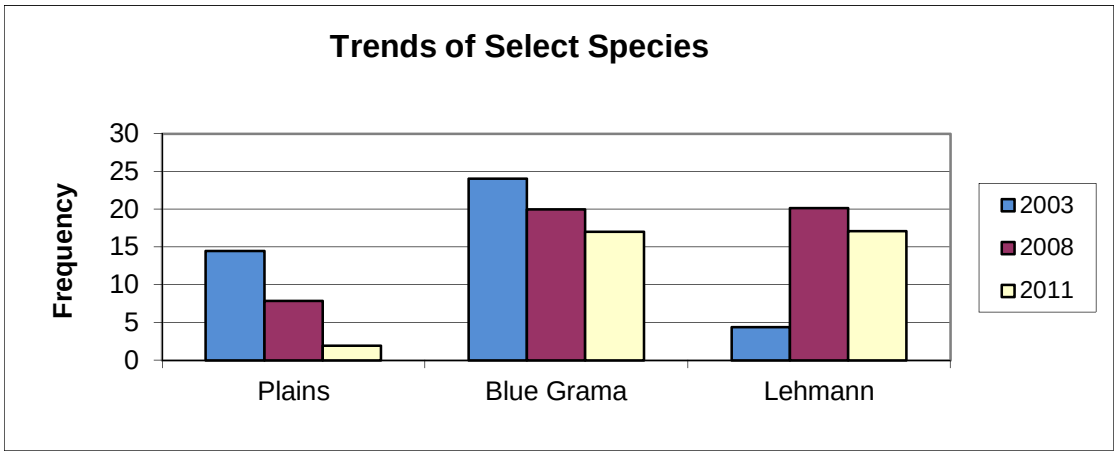
The Research Ranch is an 8000 acre sanctuary and ecological research facility in southeastern Arizona that has been ungrazed by domestic livestock since 1969. The Research Ranch is primarily Madrean Mixed Grass Prairie and is in the Babacomari River watershed. It is included in the 16-20" precipitation zone of MLRA-41. The long-term average annual precipitation is 17.5" with a bi-modal precipitation pattern – 60% during summer monsoon and 40% in the winter. Fire is a natural process of the ecosystem and wildfires have become frequent in the past 10 years.

Many research projects have been conducted on the Research Ranch since its inception, but vegetation monitoring has been a relatively recent addition to the

scope of activities. Most upland vegetation transects were established in 2003 on several ecological sites identified by the Natural Resource Conservation Service. Transects are read in the fall using the pace frequency method (4 parallel lines of 50 frames each). Cover (600 points/transect) is also recorded (data not shown). Not all transects have been read each year. Precipitation gages are located near each transect (data not shown). Below are the results from one transect on Loamy Upland that shows the frequency of some common perennial grasses. The Ryan Wildfire burned this transect in 2002.



A non-native species, Lehmann Lovegrass (*Eragrostis lehmanniana*), was introduced to the area in the mid-20th century and has invaded many acres of native grassland. During the time of this monitoring effort, frequency of Lehmann has increased dramatically in Loamy Upland sites.



This monitoring effort recorded the occurrence of early half (247) of the species documented in the published flora (586 sp.) (Geiger, et al. 2011). This is surprising considering the effort was limited to uplands and did not capture wooded or riparian areas. Annual precipitation was below the long term average for 7 of the 9 years of this study – accumulating a shortfall of more than 28". Basal cover of perennial grasses on loamy upland sites were reduced from 15% to 7% after drought/fire combination in 2002 and pre-fire levels were not reached until 2008. The dry winter of 2010/2011 caused significant grass mortality as indicated by a decrease in live basal cover and increase in litter. Two native grasses, Plains Lovegrass and Blue Grama, have exhibited a steady decline in frequency while the trend for non-native Lehmann Lovegrass is upward. We will continue to monitor these transects to capture trends in frequency, cover and precipitation patterns.

Reference:
Geiger, et al., 2011. Additions to the Flora of the Research Ranch. JANAS 43:12-15.

Interannual variability in energy exchange and evapotranspiration over two semi-arid grasslands in Arizona

Praveena Krishnan, Tilden.P. Meyers, and Mark Heuer, Atmospheric Turbulence and Diffusion Division, Air Resources Laboratory, National Oceanic and Atmospheric Administration, Oak Ridge, TN 37830, USA; Russell L. Scott, Southwest Watershed Research Center, USDA-ARS, 2000 E, Allen Road, Tucson, AZ 85719, USA. Linda Kennedy, National Audubon Society, Appleton-Whittell Research Ranch, HC1 Box 44,366 Research Ranch Road, Elgin, Arizona 85611, USA.

Continuous eddy correlation measurements of energy and water vapour above two semi-arid grasslands in southern Arizona, USA during 2004 to 2007 were examined to explain the factors controlling the seasonal and interannual variability in energy exchange and evapotranspiration (E). The study sites, a post-fire site (AG) and an unburned site (KG), received 43% to 87% of the annual precipitation (P) during the North American monsoon season (July-September) with the lowest values in the drought years of 2004 and 2005. Irrespective of the differences in temperature, surface albedo, vegetation cover and soil characteristics both sites responded similarly to changes in environmental conditions. The seasonal and interannual variations in the partitioning of net radiation to turbulent fluxes were mainly controlled by P and associated changes in soil water content (θ) and vegetation growth. Drastic changes in albedo, vegetation growth, energy fluxes occurred following the onset of the monsoon season in July. During dry or cold periods of autumn, winter and spring, sensible heat flux was the major component of energy balance whereas latent heat flux dominated during the warm and wet periods of summer. The July-September values of P, E, Priestly-Taylor coefficient and canopy surface conductance reached their lowest and the Bowen ratio reached its highest values in 2004 at AG and in 2005 at KG. During July-September, monthly E was linearly

correlated to the monthly mean θ and the broadband normalized vegetation index (NDVI), whereas during May-June the relationship between NDVI and E were not significant. Annual E varied from 264 to 322 mm at AG and from 196 to 284 mm at KG with the lowest value during the severe drought year at the site. July-September E had positive correlation with total P, NDVI and the number of growing season days during that period. Annual P explained more than 80% of the variance in annual E. The study suggested strong coupling between soil water conditions and vegetation on energy exchange and E.

Important Bird Areas of the Madrean Archipelago: a Conservation Strategy for Avian Communities

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The Important Bird Areas (IBA) Program is a worldwide program through BirdLife International that identifies sites considered to provide important habitats for avian species. Criteria for designation are species abundance, diversity and range restriction. As the United States Partner of BirdLife International, the National Audubon Society administers the IBA Program in the U.S. In Mexico, the network of AICAS is administered by CONABIO. The Madrean Archipelago has a diverse range of Identified IBAs (AICAS, Áreas de Importancia para la Conservación de las Aves, in Mexico) that feature riparian, wetland, grassland and Madrean oak woodland habitats. Five of the 24 IBAs and three of the AICAS in the region are globally significant: the Chiricahua Mountains, San Pedro Riparian National Conservation Area, Whitewater Draw State Wildlife Area, and Willcox Playa.

The purpose of designation as an IBA is highlighting the value of specific sites. The lower elevation riparian IBAs are vital for neotropical migrants in the spring as well as provide habitat for resident species. In these habitats, which are particularly productive in the spring, these species can refuel and rest before continuing on their journey north to breeding grounds. The high elevation "sky island" IBAs are very productive in the fall and serve as vital stop over points for migrants headed south and many complete their interrupted molt in these IBAs. This network serves to identify those habitats most important to conserve to benefit native birds.
Bird Conservation Region 34 –Sierra Madre Occidental - Sonoran Joint Venture
The Sierra Madre Occidental "Sky Islands" and associated grasslands and riparian corridors are a shared ecological system with Arizona and New Mexico, USA and Sonora, Mexico. The biological diversity of this region is well described and includes significant sites in Arizona such as the Chiricahua and Huachucha Mountains, the San Pedro River, and the San Rafael Grasslands. The National Audubon Society Appleton-

Whittell Research Ranch is located within the grasslands and madrean oak woodland communities. The headwaters of the San Pedro River and the southern portion of the San Rafael grasslands are in Sonora, Mexico where the continuation of the mountain sky islands provides a connection south into the sub-tropical regions of the Sierra Madre Occidental.

Among the species whose range extends into the United States in this region, highest priorities include Mexican Spotted Owl, Eared Quetzal, Lucy's Warbler, Red-faced Warbler, Strickland's (Arizona) Woodpecker, and Montezuma Quail. Riparian areas in lowlands support many in-transit migrants as well as breeding Thick-billed Kingbirds, Bell's Vireo, and Western Yellow-billed Cuckoos.

Identification of Mexico AICA's in northern Sonora and United States IBA's within the Apache Highlands ecoregion as a globally significant International IBA/AICA management zone will serve as a unifying statement of shared birds and habitats. An International and global AICA/IBA is supported by the Sonoran Joint Venture and Audubon as a contributing strategy to promote conservation of shared border birds. The uniqueness of the area that would make up this potential international IBA/AICA is apparent when the range maps of many of the species that use this area are examined. Range restriction to the Madrean Sky Islands and associated riparian areas and grasslands in the United States and the Sierra Madre Occidental system in Mexico in species such as Red-faced Warbler, Mexican Whip-poor-will, Thick-billed Kingbird, Buff-breasted Flycatcher, Blue-throated Hummingbird, Magnificent Hummingbird, Chestnut-collared Longspur and Five-stripped Sparrow among many others show the across border connectivity of this limited region. The international border that runs through this habitat zone has long served as a dividing line. These range maps show that this boundary is entirely geopolitical and not ecological, making is all more important that is area be protected as a joint effort of the United States and Mexico, these bird species don't know of any such boundary, the habitat on both sides of the border is vital sustaining healthy populations in these species.

<u>Sistema de Islas Sierra Madre Occidental/Sierra Madrean Sky Islands</u>
<u>Globally Important Species</u>:
Strix occidentalis Spotted Owl (USA and Mexico)
Euptilotis neoxenus Eared Quetzal (Mexico)
Vireo bellii Bells' Vireo (USA and Mexico) Riparian
Calcarius ornatus Chestnut-collared Longspur (Winter) (USA and Mexico) Grasslands

<u>Global Biodiversity - Assemblage of Biome-restricted species</u>
<u>Continental Important Species:</u>
Cyrtonyx montezumae Montezuma Quail
Picoides stricklandi Arizona Woodpecker
Coccyzus americanus Western Yellow-billed Cuckoo
Asio flammeus Short-eared Owl (Winter)

Otus trichopsis Whiskered Screech Owl
Micrathene whitneyi Elf Owl
Caprimulgus ridgwayi Buff-collared Nightjar
Lampornis clemenciae Blue-throated Hummingbird
Calypte costae Costa's Hummingbird
Melanerpes lewis Lewis's Woodpecker (winter)
Colaptes chrysoides Gilded Flicker
Tyrannus crassirostris Thick-billed Kingbird
Vermivora luciae Lucy's Warbler
Dendroica graciae Grace's Warbler
Cardellina rubrifrons Red-faced Warbler
Pipilo aberti Abert's Towhee
Aimophila carpalis Rufous-winged Sparrow
Aimophila quinquestriata Five-stripped Sparrow
Calcarius mccownii McCown's Longspur (Winter)
Spizella breweri Brewer's Sparrow (Winter)
Spizella atrogularis Black-chinned Sparrow
Ammodramus bairdii Baird's Sparrow

Species of Conservation Concern
Callipepla squamata Scaled Quail

Arizona Important Bird Areas:

Appleton-Whittell Audubon Research Ranch –National Audubon, BLM, Coronado National Forest – Grasslands; Montezuma Quail, Chestnut-collared Longspur and McCown's Longspur (Winter)
Buenos Aires National Wildlife Refuge – US Fish and Wildlife Service
Globally important bird species: Masked Bobwhite Quail
California Gulch – Coronado National Forest
Globally important bird species: Five-stripped Sparrow, Spotted Owl
Chiricahua Mountains – Coronado National Forest
Globally important bird species: -Spotted Owl
Whiskered Screech-Owl, Violet-crowned Hummingbird, Arizona Woodpecker, Sulphur-bellied Flycatcher, Buff-breasted Flycatcher, Grace's Warbler and Mexican Chickadee
Huachuca Mountains– Coronado National Forest
Globally important bird species: Spotted Owl
Santa Cruz River – Arizona State Park, US Park Service
Globally important bird species: Bell's Vireo
San Pedro River Riparian National Conservation Area - BLM
Globally important bird species: Bell's Vireo

San Rafael Valley – Coronado National Forest, Arizona State Park
Globally important bird species: Chestnut-collared Longspur (Winter) McCown's Longspur (Winter)
Santa Rita Mountains – Coronado National Forest
Globally important bird species: Spotted Owl
Sonoita Creek - The Nature Conservancy and Arizona State Park
Globally important bird species: Bell's Vireo
Sycamore Canyon – Coronado National Forest
Globally important bird species: Five-stripped Sparrow, Spotted Owl, Buff-collared Nightjar
Whitewater Draw State Wildlife Area – Arizona Game and Fish
Globally important bird species: Sandhill Crane

Potential Arizona Important Bird Areas:
Patagonia Mountains and Pinaleno Mountains– Coronado National Forest
Globally important bird species: Spotted Owl
Las Cienegas National Conservation Area – BLM
Rufous-winged Sparrow

New Mexico Important Bird Areas:
Clanton Canyon– Coronado National Forest
Montezuma Quail, Whiskered Screech-Owl, Arizona Woodpecker, Whip-poor-will, Elf Owl, Dusky-capped Flycatcher, Grace's Warbler
Gray Ranch Grasslands - Animas Foundation
Botteri's Sparrow
Guadalupe Canyon – Bureau of Land Management
Costa's, Broad-billed, Blue-throated, Magnificent, and Violet-crowned Hummingbird, Northern Beardless-Tyrannulet, Thick-billed Kingbird, and Varied Bunting.

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http://iba.audubon.org/iba/viewState.do?state=US-NM

Appendix: Migratory Birds of Conservation Focus
Map sources: Birds of North America; Cornell Laboratory of Ornithology:
Green= Winter;Dark Tan=Breeding; Light Tan=Migration; Blue=Yearlong

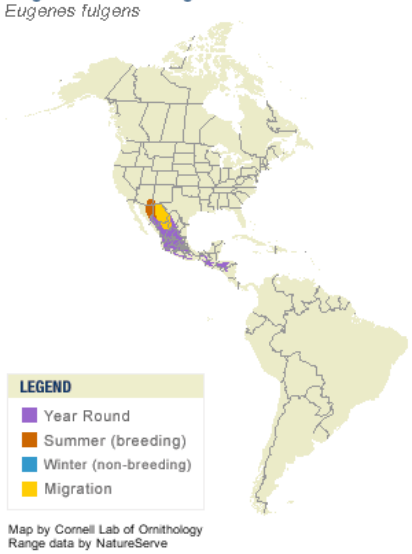
Thick-billed kingbird *Tyrannus crassirostris*

Buff-breasted flycatcher *Empidonax fulvirons*

Broad-billed Hummingbird
Cynanthus latirostris

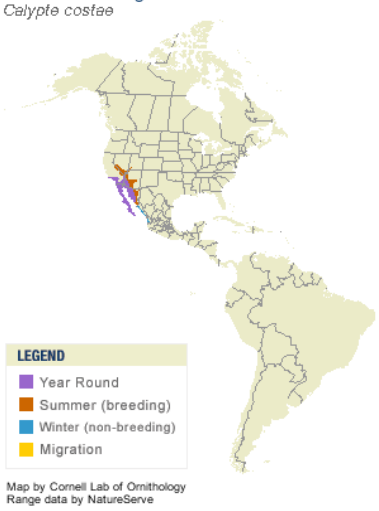
Blue-throated Hummingbird
Lampornis clemenciae

Magnificent Hummingbird
Eugenes fulgens



Lucifer Hummingbird
Calothorax lucifer

Costa's Hummingbird
Calypte costae



Rose-throated becard *Pachyramphus aglaiae*

Northern Beardless tyrannulet *Camptostoma imberbe*

Olive warbler *Peucedramus taeniatus*

Lucy's warbler *Vermivora luciae*

Grace's Warbler *Dendroica graciae*

Red-faced warbler *Cardellina rubrifrons*

Five-stripped sparrow *Aimophila quinquestriata*

Varied bunting *Passerina versicolor*

Botteri's sparrow *Aimophila botterii*

Baird's sparrow *Ammodramus bairdii* (winter)

McCowan's longspur *Calcarius mccownii* (winter)

Chestnut-collared longspur *Calcarius ornatus*

Lark bunting *Calamospiza melanocorys* (winter) (winter)

Lunch in the Party Barn

Doug Duncan, USFWS and Jennifer Ruyle, USFS stepped in to serve lunch – a great example of interagency cooperation!

Everyone enjoyed lunch provided by Resolution Copper Company, a landowning partner of the Research Ranch.