

# Science on the Sonoita Plain 2010

Quarterly Meeting  
of the  
Sonoita Valley Planning Partnership



Hosted by:  
Bureau of Land Management  
Cienega Watershed Partnership  
Appleton-Whittell Research Ranch of the National Audubon Society

August 7, 2010 – Elgin, Arizona

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**Introduction/History**

The Sonoita Valley Planning Partnership (SVPP) is a voluntary ad hoc association of agencies, user groups, conservation organizations, and individuals who work 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 Cienega Watershed while enabling sustainable human use.

The Appleton-Whittell Research Ranch (AWRR) is an 8,000 acre ecological research station dedicated to conservation of our natural resources through sound land stewardship, research and education. Comprising the southernmost portion of Las Cienegas National Conservation Area, AWRR is a cooperative effort between land owners including the Bureau of Land Management, U.S. Forest Service, Swift Current Land & Cattle Co., The Nature Conservancy, The Research Ranch Foundation, and Audubon.

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's planning committee includes representatives from the BLM, Audubon, Cienega Watershed Partnership and The Nature Conservancy. We are pleased to present this second annual Science on the Sonoita Plain symposium.

Our distinguished keynote speakers, Drs. Carl and Jane Bock, have been professors of biology at the University of Colorado since 1968 and have conducted research on the Sonoita Plain since the early 1970s. Their publications include numerous scientific papers, *The View from Bald Hill: Thirty Years in an Arizona Grassland*, and *Sonoita Plain*. They have mentored uncounted research and field assistants and fostered a legacy of scientists that is now in its third generation.

Steering Committee for the 2<sup>nd</sup> Annual Science on the Sonoita Plain Symposium: Jeff Williamson,  
Ron Tiller, Netzin Steklis, Karen Simms, and Linda Kennedy

# Science on the Sonoita Plain

Quarterly Meeting of

## Sonoita Valley Planning Partnership

**August 7, 2010**

At the Appleton-Whittell Research Ranch of the National Audubon Society

- 8:30 Sign in, enjoy coffee and light refreshments,  
courtesy of the Cienega Watershed Partnership and the Research Ranch
- 9:00 Welcome – Linda Kennedy, National Audubon Society  
SVPP announcements - Netzin Steklis
- 9:15 Keynote Speakers – Dr. Carl Bock and Dr. Jane Bock, University of Colorado
- 10:15–10:30 break
- 10:30-10:55 Ten years of research on grassland birds in Arizona  
Janet Ruth, Research Biologist, USGS Arid Lands Research Station, NM
- 10:55-11:20 Winter Bird Populations Monitoring and Citizen Science  
Tice Supplee, Audubon Arizona, Director of Bird Conservation
- 11:20-11:45 Linking groundwater, surface water, and bird monitoring at Las Cienegas NCA  
Courtney Conway, SNRE, University of Arizona
- 11:45-12:15 Q&A Session/Discussion with Morning Speakers
- 12:15-1:15 Brown Bag Lunch (Bring your own!) and Poster session
- 1:15-1:40 Cretaceous Paleontological Resources of the Sonoita Valley  
Robert McCord, Curator of Paleontology, Arizona Museum of Natural History
- 1:40-2:05 Connecting Natural and Cultural Histories on the Las Cienegas National Conservation  
Area in Southern Arizona  
Michael Johnson, Deputy Preservation Officer, BLM Arizona State Office
- 2:05-2:20 break
- 2:20-2:45 Livestock management, research and the conservation of imperiled aquatic species on  
the Las Cienegas National Conservation Area, Arizona.  
Jeff Simms, Fisheries Biologist, BLM Tucson Office
- 2:45-3:10 FROG Project: Conservation of Aquatic Vertebrates in the Cienega Creek Region  
Phil Rosen, Research Scientist, SNRE, University of Arizona
- 3:10-3:35 Ornate Tree Lizards (*Urosaurus ornatus*) – response to fire  
Aaron Cranford and Scott Bird
- 3:35-4:05 Q&A Session/Discussion with Afternoon Speakers
- 4:05-4:15 Wrap Up

# ABSTRACTS

## **Long-term livestock exclusion in an arid grassland is associated with changes in perennial grass composition and soil properties**

Ginger R. H. Allington Department of Biology, Saint Louis University

Changes in soil and vegetation due to overgrazing by livestock are occurring in arid lands throughout the world<sup>1</sup>. The most extreme cases result in desertification, which is seen as largely irreversible, due to feedback loops that perpetuate altered soil properties. Data from a recovering desertified grassland indicate that long-term rest from grazing results in: lower soil bulk density, higher water infiltration rates, no island of fertility pattern; elevated soil nutrients inside the fence. I have proposed that these changes create conditions conducive to grass recovery. However, such changes could be an artifact of the desertification process, therefore I needed to examine the consequences of long-term livestock exclusion at a non-desertified site.

This poster is being presented at the Ecological Society of America  
<http://eco.confex.com/eco/2010/techprogram/P23879.HTM>



## **Effects of Exurban Development on Biological Diversity of the Sonoita Plain**

Carl E. Bock and Jane H. Bock, Ecology and Evolutionary Biology, University of Colorado, Boulder CO 80309-0334 (carl.bock@colorado.edu; Zach F. Jones, Department of Biology, Eastern New Mexico University, Portales, NM 88130.

Throug  
hout much of  
the American  
West,  
ranchlands are  
being  
converted into  
housing  
developments.  
Potential but  
little studied  
effects of this  
exurbanization  
include habitat



loss, landscape alteration, disrupted fire regimes, and the introduction of exotics. Alternatively, species that are sensitive to the effects of grazing could benefit from exurbanization, if the developments leave sufficient natural areas that are kept free of

livestock. A confounding factor in this 'cows vs. condos' debate is that many exurbanites keep livestock on their 'ranchettes,' such that stocking densities equal or exceed those of the ranches they have replaced.

Between 2002 and 2005 we measured vegetation and counted numbers of grasshoppers, butterflies, lizards, rodents, rabbits, deer, pronghorn, and birds on 48 plots on the Sonoita Plain that were equally divided between landscapes that grazed by livestock, embedded in exurban developments, or both, or neither. Exotic vegetation did not differ among landscapes. Grasshoppers were most abundant on exurban properties that kept horses, probably because of increased bare ground and weedy forbs. Butterflies were more abundant in exurban areas, especially in open grasslands, likely because of increased nectar, shade, and water. Terrestrial lizards were scarce in grazed exurban areas, perhaps because of increased risk of predation. Rodents were relatively abundant in ungrazed areas, independent of development. Cottontail rabbits were common on ungrazed exurban plots. Deer and pronghorn were scarce in exurban areas. Both abundance and variety of birds were higher in developed landscapes, but only in those areas with relatively low housing densities.

Taken together, our results suggest that low-density housing developments (< one house per 20 acres) created a positive oasis effect for some but not all wildlife, by providing resources (shade, water) otherwise scarce in arid regions. However, these effects were largely negated by higher housing densities and by the impacts of livestock (especially horses) on vegetation.



## Monitoring



Jane H. Bock and Carl E. Bock. Department of Ecology and Evolutionary Biology, University of Colorado, Boulder CO 80309-0334. Mail to [jane.bock@colorado.edu](mailto:jane.bock@colorado.edu)

The Research Ranch Foundation was established in 1968. It was the brainchild of the late Ariel B. Appleton along with the support of her immediate family. At inception, domestic livestock were removed from the 3200 hectare ranch and this policy continues to the present. Ariel's clear and simple goal was to learn 'what nature will heal' when the land was no longer grazed by cattle and horses.

The Research Ranch presented a unique opportunity to monitor grassland and oak savannah changes that occurred with the removal of the livestock. These changes then could be compared and contrasted with those on adjacent working ranches. That has been a significant part of the work here down to the present.

Monitoring according to Webster is 'to observe with a special purpose.' Ecologists use two general sorts of monitoring, horizontal and vertical. The first is by far the more common approach, studying the same habitat in several different geographical locations.

Research here primarily utilizes vertical monitoring, i.e. studying a given place through time. (This has been misnamed *longitudinal monitoring* in some ecological literature.) To succeed at this, one must first decide what to monitor. For biologists, this requires learning the flora and fauna, no small undertaking. It takes a few years to absorb this information so you can recognize what's 'normal'. This background then allows you to recognize the unexpected, and serendipity occurs. Questions such as "Why is that here? or Why isn't it? have led to many satisfying, publishable research projects. And this raises more exciting questions for future research. Over the years, research has been carried out here by a broad representation of international outstanding environmental scientists.

In 1980 the Research Ranch gained a new identity as a Sanctuary of the National Audubon Society. Its unique purpose persists under the able direction of Dr. Linda Kennedy.



### **The power to see change: designing more effective, more efficient monitoring for population trends in the endangered Gila topminnow**

Gitanjali Bodner, The Nature Conservancy, 1510 E. Fort Lowell Rd., Tucson, AZ 85719 and Jeff Simms, Bureau of Land Management, 12661 E. Broadway Blvd., Tucson, AZ 85748

The Las Cienegas NCA supports the nation's best remaining wild population of the endangered Gila topminnow. BLM has monitored fish and their habitats annually since 1989, to screen for disease and non-native fishes, track topminnow population trends, and help managers evaluate how their actions affect the fish. We present results from 15 years of BLM fish data, test the monitoring program's ability to detect important changes, and offer options for improving the program's efficiency and effectiveness. Both perennial reaches of Cienega Creek continue to support Gila topminnow, and fish remain abundant in some sites. This creek still appears free of exotics that have devastated streams across the region. However, topminnow abundance in the upper reach monitoring sites has dropped to less than two percent of 1989 levels. Causes of decline are unclear but may include drought and habitat changes from lack of disturbance. Management experiments are needed to shed light on potential causes and help guide appropriate response. Lower reach sites have not suffered such extreme drops, but highly variable fish counts make it difficult to reliably determine whether topminnow populations in this lower reach have been stable, decreasing, or even increasing through time.

To give managers more reliable and timely information about topminnow population trends, we tested a suite of possible variations on the existing monitoring



protocol. We looked for modifications that would enable managers to detect trends that double or halve the population over either eight or ten-year spans; would preserve the ability to compare new results with the existing long-term data set; and could be implemented without increasing effort invested in topminnow monitoring. Power analysis for trend detection examined tradeoffs between effort and results. Increasing lower reach sampling stations could improve change detection in the species' current stronghold, with only a modest increase in effort. Locating new sampling stations randomly would enable results to be applied to the reach as a whole, while keeping some of the existing stations provides continuity with past data sets. Reducing uninformative habitat measurements enables staff to sample more efficiently. Refocusing upper reach monitoring on screening for exotic species and tracking topminnow distributions reduces effort while still enabling early detection of exotics and revealing major topminnow changes. Shifting topminnow trend sampling to every-other-year substantially reduces effort and would enable staff to satisfy other needs in alternate years.

This poster was originally presented at the National Landscape Conservation System (NLCS) Science Symposium, "A Decade of Discovery", held in Albuquerque, New Mexico, May 24-28, 2010.



### **Spatial patterns and trends in woody plant (*Prosopis velutina*) biomass accumulation with contrasting grazing practices (1932 to 1949)**

Dawn Browning and Steve Archer, University of Arizona, Tucson, AZ

Understanding effects of livestock grazing on long-term dynamics of woody plant biomass is of interest for terrestrial carbon (C) accounting. We used long-term data from permanent plots in southeastern Arizona to quantify rates and patterns of woody plant aboveground biomass in desert grasslands being invaded by velvet mesquite (*Prosopis velutina*). Canopies of mesquite plants within grazed and protected 1.8-ha (40-m x 440-m) plots were measured and mapped in 1932 and 1949. Allometric relationships between canopy area and biomass were used to estimate C mass associated with woody plant encroachment in each setting. Ripley's K, an index for assessing the spatial arrangement of point patterns as a function of distance, was used to describe the spatial arrangement of mesquite plants. Changes in mesquite size class distributions were used to infer impacts of grazing on plant population dynamics and carbon storage potential. Woody biomass was similar when grazing treatments were implemented in 1932. Total woody biomass increased nearly 3-fold from 7,523-kg in 1932 to 20,866-kg in 1949. Increases in mesquite biomass on plots protected from cattle grazing (3,699 to 12,981 kg ha<sup>-1</sup>) were 2.5 times that occurring on grazed plots (2,482 to 5,252 kg ha<sup>-1</sup>). Mesquite recruitment was higher on ungrazed plots (488 plants) than on grazed plots (344 plants) from 1932 to 1949, resulting in a significant shift in population structure to smaller canopy size classes (Kolmogorov-Smirnoff = 5.433,  $p = < 0.0001$ ). Mortality was low (4.0%



versus 9.5% on ungrazed and grazed plots, respectively) and dispersed among all size classes; therefore changes in the spatial arrangement of mesquite plants over 17-yr were driven by patterns in establishment of new individuals. Spatial patterns of mesquite plants on grazed and protected plots were clustered beyond that expected for complete spatial randomness. On grazed plots, intensification of clustering from 1932 to 1949 suggests recruitment occurred near existing plants. In ungrazed plots, recruits filled inter-canopy spaces more effectively, somewhat dampening the clustered pattern. The extent to which these dynamic changes in woody biomass have affected net changes in ecosystem carbon pools to date is currently being assessed.

Poster originally presented at Ecological Society of America. 2006.  
<http://abstracts.co.allenpress.com/pweb/esa2006/document/63620>



### How much are we missing? Field validation of historic aerial photography

Dawn M. Browning<sup>1,3</sup>, Andrew T. Byrne<sup>2</sup> and Steven R. Archer<sup>1</sup> <sup>1</sup> School of Natural Resources and the Environment, University of Arizona, Tucson, AZ 85721, <sup>2</sup> Biology Department, Clarkson University, Potsdam, NY 13699 <sup>3</sup>U.S.D.A., Agriculture Research Service, Jornada Experimental Range  
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Abstract not available

Poster first presented at the 2008 Joint Meeting of the Society for Range Management and the America Forage and Grassland Council. Louisville, KY. Jan 26-31, 2008.



### Linking groundwater, surface water, and bird monitoring at Las Cienegas NCA

C.J. Conway, C. Kirkpatrick, and D. LaRoche.

Riparian woodlands in the southwestern United States constitute <1% of the desert landscape yet typically support >50% of the breeding birds. The high species richness of birds in desert riparian woodlands relative to surrounding vegetative communities is commonly attributed to the structural complexity of



the vegetation. However, little is known about the role that surface water itself plays in determining the relative value of riparian woodland to birds in the desert southwest. To address this need, we have been quantifying the link between the amount of surface water with the abundance and diversity of birds in Las Cienegas NCA and other desert riparian woodlands in the region. We found that riparian areas contained 68% more species and 75% more individual birds compared to adjacent uplands. And within riparian woodlands, the presence and extent of surface water was positively associated with both total relative abundance and species richness of riparian birds. For the majority of riparian birds that we analyzed, abundance was positively associated with surface water. If long-term drought conditions persist and/or ground water levels fall to the point where surface water flows are reduced or eliminated, populations of many birds are likely to decline. Results from our study provide quantitative data that will allow resource managers to better predict how the abundance and diversity of riparian birds will be affected by future reductions in ground and surface water levels within riparian woodlands in the desert southwest. Moreover, our results can provide important data with which to support agencies' efforts to conserve riparian woodlands in the desert southwest by preserving their hydrologic and biological resources.



### **Influence of ecological context on benefits of communication in honey bees (*Apis mellifera*)**

Matina C. Donaldson-Matasci and Anna Dornhaus, Department of Ecology & Evolutionary Biology, University of Arizona, Tucson,  
matina@email.arizona.edu

The honey bee dance language, used to recruit nestmates to flowers, is thought to be adaptive because it allows the colony to collect resources more efficiently. However, researchers have shown that it is not always beneficial: the dance language only increases nectar collection in certain habitats, while in others it seems to have no impact. Why? One important factor may be the way flowers are distributed around the hive. For example, if flowers are difficult to find, then communication might be important mainly because it allows many recruits to take advantage of a single scout's find. Alternatively, if flowers are easy to find but highly variable in quality, then communication might be important mainly because it allows the colony to concentrate on the best resources. Here we report initial results of experiments across several different natural desert habitats, showing how the floral distribution relates to the value of dance communication in honey bees.

Poster originally presented at the Animal Behavior Society meeting in Williamsburg, Virginia, July 25-30, 2010.



## Change in Wetland Cover, 1992-2001, Pima County, Arizona

Julia Fonseca, Pima County Office of Conservation Science and Environmental Policy and Cory Jones and John Regan, Pima County GIS

Federal agencies used Landsat imagery from 1973 to 2000 to report on land cover and land-use change in the U.S. Our work, based on corroborating a subset of this imagery known as the National Land Cover Dataset (NLCD), suggests that forested wetlands may have increased in Pima County, even as the footprint of urban and industrial development has expanded. This change is consistent with regional trends for broadleafed riparian forests (Webb and Leake, 2006; Webb et al., 2007; Jones et al., 2008).

Poster originally presented at the Fifth Annual Symposium: Research Insights in Semiarid Ecosystems (RISE) in Tucson, AZ. Oct. 11, 2008.



## Connecting Natural and Cultural Histories on the Las Cienegas National Conservation Area in Southern Arizona



Michael Johnson<sup>1</sup> and Amy Sobiech<sup>2</sup>. Bureau of Land Management – <sup>1</sup>Arizona State Office, Phoenix, AZ and - <sup>2</sup>Tucson Field Office, Tucson , AZ

A recent discovery of human skeletal material more than three meters below modern surface in Las Cienegas Creek has led to an opportunity for non-destructive geomorphological research as part of an effort to date the time of deposition of the human remains. The discovery of additional associated and unassociated archaeological materials places the area in a context established through previous archaeological research. This archaeological and geomorphological research, including relative and absolute dating of soils and organic materials, allows natural and cultural scientists to reconstruct the age, sequence, and intensity of different types of human impacts on the ecosystem of the

Las Cienegas Creek National Conservation Area, as inferred from sediment types and deposition rates. The geomorphological data are combined with the archaeological, ethnohistoric, and historic records of the area in an effort to better understand the environmental effects of different cultural and socioeconomic systems. This research is part of an ongoing effort to better understand how humans affect the environment, and how changes in the environment dictate changes in human adaptations.



### Ornate Tree Lizards (*Urosaurus ornatus*) – Response to fire

Matthew Lattanzio, Aaron Cranford\*, Scott Bird\*. Department of Biological Sciences, Ohio University, Athens, Oh 45701

Prescribed fire is a common restoration and management practice used by Land Managers to mimic natural disturbance and enhance faunal diversity in the southwestern US. However, the ability to predict the responses of wildlife to prescribed (and wild) fire has been mixed. Most studies have focused on numerical responses to burning and ignored behavioral or other life history responses. Determining these responses is critical, however, because they are a direct measure of whether burned habitats allow species to maintain stable or growing populations. This study evaluates the population dynamics, behavioral, and life history responses of common and endangered reptiles to prescribed burns at



two field sites in southeast Arizona. We are collecting data on Ornate Tree Lizards (*Urosaurus ornatus*) between June and September of 2009-2012 to determine both the short- and long-term responses of tree lizards to fire use. Two sites are established: a site burned twice (North Site) and once (South Site) in the past 20 years at the Appleton-Whittell Research Ranch near Elgin, AZ. Previous studies in this vein have generated mixed results:



although many demonstrate an increase in the use of burned habitats by reptiles, to date no studies have demonstrated that these species exhibit positive population growth rates. Species that vary in their degree of habitat and resource specialization may also vary in their life-history and behavioral responses to fire. This study

strategically integrates measures of energy and trophic dynamics and allocation with measure of fitness components including dominance and endurance capacity to more fully understand the impact of prescribed fire on wildlife communities. It will build upon and expand past studies by utilizing isotopic tissue analysis to estimate nutrient dynamics, resource use, and energy flow at each site. This integrated methodology facilitates understanding how prescribed burns affect the functional use of affected habitat by reptiles relative to non-burned controls.



### **Cretaceous Paleontological Resources of the Sonoita Valley**

Robert McCord, Arizona Museum of Natural History, 53 N. Macdonald St. Mesa, AZ 85201

The Sonoita Valley possesses the richest Cretaceous paleontological resources in southern Arizona. These fossils are distributed in three formations. From



oldest to youngest they are: the Turney Ranch Formation, the Shellenberger Canyon Formation and the Fort Crittenden Formation. The two oldest formations were deposited in the Bisbee Basin, a rift valley that extended from Chihuahua northwest to the Tucson Area. The Shellenberger Canyon Formation is Albian Age (112-97 Ma) beachfront with interbedded marine and terrestrial sediments. The lithologically similar Turney Ranch Formation is of likely Cenomanian

Age (97-90 Ma) and is exclusively terrestrial, representing a time when the seaway was receding. The Fort Crittenden Formation is of Campanian Age (83-74 Ma) and was deposited in and near intermontane lakes. All three formations are of proven paleontological potential, with significant questions remaining unanswered. The Shellenberger Canyon Formation has produced: *Tenontosaurus*, a sauropod, turtle, fish, mollusks, petrified wood and possibly nodosaur and crocodilian remains. The Turney Ranch Formation has produced: *Sonorasaurus*, ankylosaur, ornithopod, theropod, turtle and petrified wood remains. The Fort Crittenden Formation has produced: titanosaur, hadrosaur, ceratopsid, tyrannosaur, crocodile, several genera of turtles, fishes, petrified wood, palynomorphs, and mollusks. Sufficient remains for generic identification in all these faunas is, by in large, lacking limiting faunal and phylogentic comparisons. The potential for new taxa, particularly in the Shellenberger and Turney Ranch Formations is high. The faunas are of special interest due to their being among the southernmost Cretaceous faunas in the United States, the paucity



of information about Mexican Cretaceous faunas and the evident increasing latitudinal provincialism in the western interior during the Cretaceous. Sadly, despite their potential importance, these faunas have been comparatively little studied, and are subject to an unusually high degree of looting.



## **Lehmann Lovegrass in Southern Arizona: Research Results and Management Implications**

Chris McDonald, University of California, Cooperative Extension,  
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Many nonnative invasive grasses have altered fire regimes to the benefit of the introduced species. In southern Arizona managers are wary of using prescribed fire as it may benefit the introduced Lehmann lovegrass (*Eragrostis lehmanniana* Nees) and possibly promote a nonnative grass/fire cycle. However, examples of the grass/fire cycle originate in ecosystems where native plants are less fire-tolerant than grasses, and are atypical in fire-prone communities. Two studies were conducted to describe the changes in a semi-arid grassland treated with prescribed fire and livestock grazing. First, I investigate the effects of fire on the survival of individual grasses on plots dominated by Lehmann lovegrass, native grasses or a mixture of the two. Second, I investigate the changes in the plant community due to treatment with prescribed fire and livestock grazing. Native grasses had a higher survival, and in some cases nearly double that of Lehmann lovegrass on burned and unburned plots. While a number of invasive seedlings germinated after fire treatments, the percent of established Lehmann lovegrass plants did not increase two years after treatments. Lehmann lovegrass does not appear to alter the fire regime of semi-arid grasslands to the detriment of native grasses and herbaceous dicotyledons. Grazing negatively affected native plants, as did the combination of prescribed fire and livestock grazing. Also, Lehmann lovegrass produces more biomass than native plants. The combination of these results suggest that native grasses, like the proverbial Tortoise, are surviving at a slow and steady rate, while Lehmann lovegrass, like the Hare, races as it grows, takes a break when burned, and then races again to catch up. Consistent with previous research fire does not promote the spread of Lehmann lovegrass, and more importantly human alteration of the fire regime is greater than the nominal effects of Lehmann lovegrass introduction on the fire regime.



## **Buffelgrass Invasion and Intense Fire Behaviors**

Chris McDonald, University of California, Cooperative Extension  
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National Park, Perry\_Grissom@nps.gov (520)733-5134

Buffelgrass (*Pennisetum ciliare* (L.) Link) is a textbook example of the grass/fire cycle and has the potential to transform the shrublands of the Sonoran Desert into a fire-prone grassland. Effects of a buffelgrass invasion have been documented from Australia to North America, pointing to an end result of large-scale wildfires. Although much research has been conducted on buffelgrass, relatively little is known about fire behaviors produced by a buffelgrass-fueled fire. We measure fire-behavior characteristics and fuel loads in 4 prescribed fires in southern Arizona. We also determine which abiotic and biotic characteristics best predict fire behavior. Given that buffelgrass is known to decrease native plant richness in other ecosystems, we evaluate the relationship between buffelgrass abundance and native plant cover at 2 different sites in southern Arizona. Compared to previously described buffelgrass stands and also across different desert ecosystems, buffelgrass fuel loads were higher than reported in many other studies. Buffelgrass fires are more intense than fires in surrounding ecosystems, even in communities with comparable fuels. There was no relationship between fuel load and fire temperature, likely because increased fuel was insufficient to contribute to additional fire intensity beyond minimum fuel loads. There is a strong negative relationship between buffelgrass cover and native plant cover. As managers have used herbicide to reduce buffelgrass fuel loads; we find that even after 3 years of decomposition, stands of dead buffelgrass can support fire spread. Finally, if a buffelgrass-fueled fire were to begin in the Sonoran Desert, native plant communities could be irrevocably altered. If management goals include restoration or preservation, we suggest control of any population of buffelgrass before fuels accumulate sufficiently to support fire spread or before native plants decline in abundance.



## **Soil and Water Conservation Research at the Audubon Research Ranch**

Mary Nichols (Scientist, USDA-ARS Southwest Watershed Research Center),  
Tucson, AZ and Mike Crimmins (UA Extension Climate Specialist), Tucson,  
AZ

The USDA-Agricultural Research Service Southwest Watershed Research Center in Tucson has been collaborating with the Audubon Research Ranch and the University of Arizona Extension Service to address several soil and water conservation issues on semiarid rangelands. Sediment is a primary pollutant in runoff from western watersheds. Long-term Sediment yields have been measured at the ranch headquarters pond to characterize sediment transfers on the ranch. Recently,



a high resolution photographic system was tested at the ranch as part of a project to develop new monitoring technologies for documenting and characterizing rangelands. In August of 2010, a water conservation project will be set up to test and demonstrate the efficacy of a cover for open water tanks. The cover will reduce evaporation losses thereby conserving water. This type of applied technology is critical for mitigating potential impacts of extended droughts associated with predicted climate change.



### **Encouraging Energy Conservation and the Use of Alternative Energy: A Model for Rural Communities**

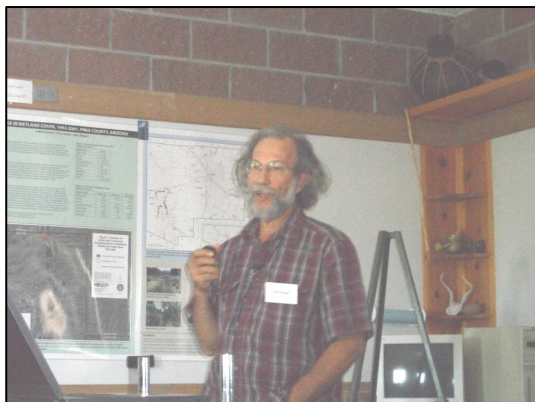
Wayne Porter, *TogetherGreen* Apacheria Fellow, Practical Energy for Rural Communities. MS Student, Arizona State University School of Sustainability

A case study that describes the efforts of members of the Elgin, Sonoita and Patagonia communities in northeastern Santa Cruz County, Arizona to reduce their own greenhouse gas emissions and to encourage others to do the same. The origins of the Sonoita Crossroads Community Forum's Renewable Energy Subcommittee and the formation of the Practical Energy for Rural Communities organization are outlined.

The activities and accomplishments of the two groups are listed, along with the goals and plans for the future of PE4RC or its successor organization.



### **FROG Project: Conservation of Aquatic Vertebrates in the Cienega Creek Region**



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The F.R.O.G. (Fish and Frog Restoration and Outreach Group) Project focuses on native fishes, ranid frogs, turtles, and gartersnakes in the Cienega Creek region, including Sonoita Grasslands. Currently funded for 3 yr by National Fish & Wildlife Foundation, the project

is a collaboration of University of Arizona and Cienega Watershed Partnership. Species of most concern are Gila Topminnow, Chiricahua Leopard Frog, and Mexican Gartersnake, which are listed as Endangered, Threatened, and Candidate species, respectively, under the Endangered Species Act. This project involves (1) status and trends, (2) conservation biology research, (3) community outreach and involvement, and (4) habitat and population restoration.

We are surveying distribution and status of ranid frogs (including the invasive non-native American Bullfrog), fishes and gartersnakes (3 species each), and the Sonoran Mud Turtle. Our results will enable us to establish long-term trends based on monitoring since 2002 and field observations dating to 1985.

Unique features of this system are dominance of native aquatic vertebrates and scarcity of non-natives. No non-native fishes inhabit the creek, although we recently discovered mosquitofish (*Gambusia affinis*) in a private pond in the basin, posing a grave threat to the topminnow. Bullfrogs were first detected in 1986: their scarcity and impact on leopard frogs are research topics. The Mexican Gartersnake population declined after bullfrog spread and leopard frogs became rare. Non-native Northern Crayfish (*Orconectes virilis*) arrived at a headwaters pond ca. 2006 and pose a third major threat.

The growing human population in the basin raises the specter of non-native species proliferation, followed by loss of the native aquatic vertebrates. Only widespread community awareness and collaboration can avert this. Conservation actions involve intensively removing all non-native aquatic species, creating and renovating aquatic habitat, releasing captive-propagated frogs and gartersnakes, and mitigating disease problems in leopard frogs.



### Ten Years of Research on Grassland Birds in Arizona

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Research on winter and  
breeding ecology and distribution  
of grassland birds has been  
conducted in semi-desert and  
plains grasslands of southeastern

Arizona on the Audubon Appleton-Whittell Research Ranch, as well as BLM's Las Cienegas NCA, US Forest Service, USFWS, and private ranch lands. This research has been supported by multiple funding (and in-kind) sources and has also involved



large numbers of field volunteers. Research has included six years of work on wintering habitat associations of grassland birds, three years of post-wildfire research, two years of work on breeding distribution and abundance of Arizona Grasshopper Sparrow, and the second of three years of research on breeding ecology of Arizona Grasshopper Sparrow. This presentation will summarize information about (1) the associations of a suite of winter sparrow species with habitat characteristics such as shrub density, grass density, bare ground, dead litter, and exotic grass; (2) comparisons between historic and current surveys of Arizona Grasshopper Sparrow distribution and abundance; and (3) some preliminary information about the new study of breeding ecology of Arizona Grasshopper Sparrow. Information will be presented in the context of the partnerships and collaboration that made this research possible.



**Livestock management, research and the conservation of imperiled aquatic species on the Las Cienegas National Conservation Area, Arizona**

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Cienega Creek located within the Las Cienegas National Conservation area was acquired in 1988 from the Anamax Mining Corporation. The area has multiple designations: National Conservation Area, Area of Critical Environmental Concern, Wild and Scenic River Study Area, DEQ- Unique Water, and Critical Habitat for Gila chub. It supports an abundance of aquatic species in streams and wetland including Gila topminnow (E), Gila chub (E), Chiricahua leopard frog (T), lowland leopard frog (BLM-S), Mexican gartersnake (C), and Huachuca water umbel (E),

Riparian/aquatic conditions over a 22 year period have drastically changed primarily due to changes in livestock management implemented by the Bureau. Some assumptions concerning the impacts of changes in livestock management were found to be off target. Monitoring has shown that the expected flood effects on riparian tree abundance did not materialize, leaving the aquatic habitat shaded in many, but not all stream reaches, resulting in alteration of the food web for Gila topminnow.

Evaluation of Gila topminnow populations, riparian trend and water quality data indicate that habitat suitability has decreased in some reaches of Cienega Creek. Studies that evaluated disturbance from large animals such as cows and saltcedar removal have demonstrated that high vegetation densities can affect fish community persistence and productivity. Since management goals for the Gila topminnow are not being met for the LCNCA, adaptive management strategies are being evaluated to improve the population size of this fish. Further study of the environmental preferences and tolerances of this species are necessary to identify the requirements of topminnow in springs and small creeks. In particular, the ecological relationships between topminnow and food webs driven by primary productivity in warm sunny environments in comparison to those in settings dominated by leaf litter and cool, shady conditions need attention. Ideally we need to investigate:

- the relationship between canopy/ambient light conditions and topminnow population size in the field
- primary production – algal driven food chains vs. litter driven food chains and topminnow reproductive rate and growth in the lab
- temperature's role in reproductive rate and growth in the lab for this thermophilic species.



### **What happens when the cows come off? A unique opportunity for collaboration**

Karen Simms, Bureau of Land Management, National Landscape Conservation System; Linda Kennedy, Appleton-Whittell Research Ranch of the National Audubon Society; and Christine Hass, Borderlands Carnivore Studies

An innovative experiment – large-scale exclusion of domestic livestock from rangeland – is providing insight into natural processes and guidance for management of southwestern grasslands. The Appleton-Whittell Research Ranch is a cooperative effort between the Bureau of Land Management, National Audubon Society, Swift Current Land & Cattle Co., The Nature Conservancy of Arizona, The Research Ranch Foundation, and the U.S. Forest Service, managed by Audubon under contractual agreements with the various landowners. Comprising the southernmost portion of Las Cienegas NCA in southeastern Arizona, the 8000 acre sanctuary for native plants and animals and ecological research station has been ungrazed by



domestic livestock since 1968 and is surrounded by active cattle ranches. The Research Ranch provides a control or reference area for cross-fence research projects on topics including native and invasive species, fire, riparian systems, and shrub encroachment. More recently a new role has emerged for the Research Ranch as a reference area by which to evaluate the impacts of exurbanization as the human population in the areas increases. Several hundred scientific publications and numerous management guidelines have resulted from past research, and over forty research and monitoring projects are ongoing. The first annual Science Symposium of the Sonoita Valley, held in May of 2009, hosted by the Sonoita Valley Planning Partnership and held at the Research Ranch, shared results from research on Las Cienegas with community members.

This poster was originally presented at the National Landscape Conservation System (NLCS) Science Symposium, "A Decade of Discovery", held in Albuquerque, New Mexico, May 24-28, 2010.



## Winter Bird Populations Monitoring and Citizen Science

Tice Supplee, Audubon Arizona Director of Bird Conservation. Phoenix, AZ

Avian studies of populations must consider the status of a species or group of species at different points in the annual cycle. Because birds migrate, some for very long distances, the status of birds away from breeding grounds is often unclear. Banding studies and the more recent advent of radio telemetry has advanced our overall knowledge. Winter and migration population studies remain challenging for some species as the timing and the selection of wintering sites and migration pathways often vary from year to year.



Numerous citizen science and volunteer bird counting programs compliment the survey efforts of biologists. The advent of easy to use online data entry systems such as eBird coupled with organized count efforts such as the Great Backyard Bird Count have greatly increased winter bird population information. The oldest of these volunteer programs in North America is the Audubon Christmas Bird Counts (CBC).

Southwestern desert grasslands in the U.S. and Mexico are highly important migration stop over and wintering areas for grassland bird species, including some that are of conservation concern that include Brewer's and Baird's Sparrows, Mountain Plover, Short-eared Owl, and McCowan's Longspur. Additional winter bird population data is needed to determine the significance of grasslands sites in the southwest United States and northern Mexico.



### **Introduction of Huachuca Water Umbel, an Endangered Wetland Plant Endemic to Southeast Arizona, at Audubon Research Ranch**

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Huachuca water umbel (HWU) is an endangered wetland species endemic to southeastern Arizona and little is known about the species' ecology. Using greenhouse-propagated material, we introduced 128 individual HWU plugs into four spring-fed wetland sites with a range of habitat conditions at Findley Tank, Audubon Research Ranch. After two years, overall survival of transplanted plugs was 60% and the area occupied had increased by 845%. We also examined the number of viable seeds incorporated into a seedbank at the study location in the first season after transplanting. This case study offers a model for watershed-wide reintroduction efforts of this endangered plant. The study also illustrates the importance of low level disturbance and the necessity of long-term monitoring and maintenance of competing plant species in establishing viable species reintroductions.



Lunch on the south patio was an enjoyable option!