

APPLETON-WHITTELL RESEARCH RANCH

of the

NATIONAL AUDUBON SOCIETY



ANNUAL REPORT

2011



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

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

GOALS

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

From the Director

Preparing this annual report has been a great opportunity for me to look back and relive some of the exciting moments. We, Pat, Roger and I, get so focused on what needs to be done next that we forget what has been accomplished. I hope you enjoy reading some of the high points (and occasional low points) associated with this, the 31st year since the Appleton-Whittell Research Ranch of the National Audubon Society came into being, charged with conservation of our beautiful southwestern grasslands and the animals that depend upon them!

~Linda Kennedy

Audubon Staff on the Research Ranch
Roger Cogan, Conservation Coordinator
Linda Kennedy, Ph.D., Director
Pat Kugler, Office Manager

Audubon Staff in Phoenix:
Sarah Porter, V.P. and Executive Director
Sam Campana, Founding Director
Becky Gilbreath, Finance & Office Manager
Emily Morris, Teacher/Naturalist
Steve Prager, Teacher/Naturalist
Valerie Ramos, Development Associate
Reid Robinson, Custodian
Randy Schilling, Development Director
Tice Supplee, Director of Bird Conservation
Cathy Wise, Education Director

Table of Contents

Volunteers.....	4
Conservation	
Endangered Pupfish Population.....	5
Fire.....	6
Cross-border Traffic, Water for Wildlife	7
Non-native Invasive Species	8
Research and Monitoring	
Apacheria Fellowship, New Research Projects	9
Monitoring.....	10
Outreach and Education	
Living Gently on the Land.....	13
Science on the Sonoita Plain.....	13
Energy Exposition.....	14
RISE, Field Trips and Staff Participation.....	15
Fiscal Situation	16
Publications associated with the Research Ranch.....	17
Active Research/Baseline Projects	20
The First 25 Years: BLM and Audubon.....	26



Volunteers



Volunteers play many roles in at the Research Ranch – all valuable! Our volunteer year started out with a welcome e-mail from a former intern, **Erika Geiger** (left), who had a few months in between positions and offered to help us out. Since her internship in the 1990s she had completed a M.S. and Ph.D., and a post-doc in Brazil. Before heading to her new role with the U.S. Geological Survey in Utah, Erika compiled a new list of plants added to our flora since she, Steve McLaughlin, and Jan Bowers had completed the first Flora of the Research Ranch (2001). This addition (72 new species) was published this fall (see Publications starting on page 18). **Lois Albrecht** includes the Research Ranch in her winter volunteer tour and began a booklet that will serve as a guide for landowners in SE Arizona that wish to emphasize plantings for hummingbirds. She'll be back in 2012 to finish the booklet and to organize a station report of recent research. **Virginia Dean**, a neighbor who regularly walks to the Headquarters, has been assisting with many activities (see photo, below), and has undertaken the huge task of compiling the known biodiversity of the Research Ranch. **Charlie Schulz**, fearless leader of a **Sierra Club**

Service Tour group, headed up an impressive group of nine volunteers this fall for their 8th appearance at the Research Ranch. This year the group transplanted planted sacaton into a floodplain dominated by non-native Bermudagrass, removed old fencing to make the Ranch safer for wildlife, landscaped around the Headquarters, dug a trench for electrical wire at the Ranch house, and painted, painted, painted! Other long-term volunteers include **Betsy and Sandy Kunzer**, who monitor the depth to groundwater in all our wells and **Jim Koweek** who helps Linda with vegetation monitoring. **Ralph Dinsman** (who used to lead the Sierra Club Service Tour group) spent a week here this spring helping Roger install new flooring in a bedroom of the bunkhouse and many other tasks. Our team of volunteering spouses, **Joanie Cogan, John Kugler** and **Dan Robinett** pitch in wherever needed!



Serving lunch at the Science on the Sonoita Plain Symposium, volunteers Joanie Cogan, Virginia Dean and John Kugler.



CONSERVATION

Endangered Pupfish Population on the Research Ranch!



More than 70 people participated in the release of 229 desert pupfish, *Cyprinodon macularis*, at the Research Ranch on June 4th. The release was part of the annual Science on the Sonoita Plain Symposium, a quarterly meeting of the Sonoita Valley Planning Partnership. Earlier 600 Rio Sonoyta pupfish had been removed from the pond at the Research Ranch and transported to two different refuges. The Rio Sonoyta pupfish are also

endangered, but are not native to the immediate area. The pond was dried down completely and then refilled for the release of desert pupfish which are native to the Research Ranch area.

The lead biologist on this effort, Ross Timmons of the Arizona Game and Fish Department brought the desert pupfish from the Robbins Butte wildlife area and delivered a presentation on the Desert Pupfish and Topminnow Safe Harbor agreement during the Symposium. Doug Duncan, USFWS, provided technical support. Linda Kennedy, Director of the Research Ranch, was thrilled to release the first pupfish in their new home. Girl Scouts and one Boy Scout from Sierra Vista who had come to the Symposium because of their interest in native fish conservation experienced first hand conservation as they participated in the release. Other Research Ranch partners were represented by Tom Dabbs (BLM), Gita Bodner (The Nature Conservancy) and Debbie Sebesta (USFS) who each took turns releasing the new arrivals. Even Sam Salzwedel, KOLD news, who featured the release in the 6:00 p.m. newscast, put down his video camera long enough to gently release pupfish into the pond.



Although one fish died in transport, the survivors very quickly acclimated to their new home, some turning blue (breeding color) within two hours of release. Fry were documented in the pond less than one month later and by fall it was clear the release was a success!

Fire



The dry winter of 10/11 left our grasslands dry and ripe for wildfire. Unlike 2010, when there were no fires reported on the Research Ranch, four separate fires were ignited on the Ranch. Three of the fires were lightning fires, immediately prior or during the monsoon season. All told, there were less than 200 acres burned on the Ranch as response teams quickly extinguished each blaze.

Normally we would have encouraged the fire crews to allow the fires, especially the summer events, to burn more acreage, but the extremely dry winter had stressed the plants so this wasn't a good year to burn. As always, we practice "FireWise" principles to protect Audubon buildings and personnel and are grateful for the rapid and professional response from the fire crews – especially our local teams from the Sonoita-Elgin Fire District.



Photos of July 19 wildfire – 1.5 miles west of Headquarters.



Cross-border Traffic

This is the third straight year that cross-border trespass has declined on the Research Ranch. We did have one interesting experience this year, when we noted unusual activity on Bald Hill. On closer examination we found a military crew from Ft. Huachuca assisting Border Patrol by taking up position in a concrete water tank that was temporarily dry. A call to Border Patrol quickly resolved the case of mistaken location!



Water for Wildlife

Humans have had many impacts on the grasslands and associated habitats of the southwest, but few have been more important to wildlife than the changes in hydrology. Springs no longer run, perennial streams are now ephemeral, cienegas are dry. On the Research Ranch we try to compensate somewhat by providing artificial water sources.

This year our partners really stepped up to assist as the Bureau of Land Management rehabilitated both Bald Hill tank (see above) and Pronghorn tank. Large solar arrays power pumps that provide water into each tank. New windmills, courtesy of Resolution Copper Co., are now bringing water to Vaughn Canyon tank and the Appleton house parcel.

By providing water at a range of sites across the Ranch, animals do not need to travel so far and are not subject to the level of predation that they would experience if there were only a few sites with open water. In



addition, perennial waters provide habitat for species in need of special efforts. Plans are underway to establish populations of endangered Chiricahua Leopard Frogs into the BLM tanks in the spring of 2012. It is hoped that these populations will spread to other favorable sites (such as Vaughn Canyon) in the future.

Non-native Invasive Species

One of the reasons that the Research Ranch has become a site for reintroduction of endangered fish and frogs is our commitment to the ongoing challenge of reducing bullfrog populations. Bullfrogs were introduced into Arizona from central and eastern states, and are highly predatory on native fish, reptiles and amphibians. They also spread a disease that has a high mortality rate in native frogs. This year we removed six frogs, five from the dams near Post Canyon and one from the Headquarters pond.

Our efforts to protect sandy loam uplands from Lehmann and Boer Lovegrass have been effective as the frequency of non-natives in this site was below 1% this year. By carefully using herbicide as needed to eliminate non-native species, this site can serve as a reference area and may also, in the future, be a source of site-adapted native seed for rehabilitation efforts.

With financial support from the RIESTER Foundation and lots of volunteer effort such as the Sierra Club Service Tour group in photo, below, we are continuing to transform monocultures of Bermuda grass (a relict from the ranching days) into more biologically diverse communities by transplanting sacaton, *Sporobolus wrightii*, into the Post Canyon floodplain. Sacaton grassland is found in less than 5% of its original range and is a valuable habitat for wildlife.





RESEARCH and MONITORING

The **Apacheria Fellowship Endowment** took a huge leap this year towards our goal of \$20,000 upon receipt of a generous bequest from a friend of the Research Ranch! Successful Apacheria Fellowship applicants are college students (undergraduate or graduate) who are conducting research consonant with the Research Ranch mission. Past Apacheria Fellows include Ginger Allington (University of St. Louis), Pedro Chavarria (Texas A & M), Travis Nauman (Univ. of Arizona), Clay Nichols (University of Eastern New Mexico), Kelley O'Neal (University of Maryland), and Wayne Porter (Arizona State University). We are currently accepting applications for the 2012 Apacheria Fellowship program.

New Research Projects

The Research Ranch is an independent ecological field station with rigid criteria for research (http://researchranch.audubon.org/Research_Conducting.html). For a project to be considered it must protect the biological integrity of the Research Ranch, inform citizens and leaders of ways to safeguard regional grassland communities and provide archived information that can be used by future scientists. The following projects were accepted in 2011:

Merging functional ecology and phylogenetics to predict the response of grasslands to global change



“My research is a large comparative study of broad precipitation gradients in North America, South Africa and Australia exploring whether these grasslands converge in their community structure and ecosystem function despite divergence in their evolutionary and biogeographic histories.”
Beth Forrestel and Melinda Smith, Yale University

Species Boundaries and Phylogeography of the Dwarf Milkweed Group

“*Asclepias uncialis*, *A. ruthiae*, *A. sanjuanensis*, and *A. eastwoodiana* are closely related dwarf milkweed species that occur in xeric habitats across large portions of Colorado, New Mexico, Utah, Arizona, and Nevada. Species boundaries and the relationships between putative species are not well understood within this small group of milkweeds and there has been disagreement over the taxonomic status of several of these species. *Asclepias eastwoodiana*, *A. sanjuanensis*, and *A. uncialis* are all species of concern to one or more land management agencies where they occur. We plan to collect leaf tissue for DNA analysis of



species in this group to conduct a study examining species boundaries and phylogeography across the range of the four species.”

James P. Riser II (photo) and Eric Roalson, Washington State University

Pollination ecology of the grassland shrub *Krameria erecta* (littleleaf ratany)

“The study of *Krameria* pollination touches on a current issue in ecology and conservation biology, how mutualist diversity relates to species coexistence and community stability (Palmer et al. 2003). This field study will provide information about how dependent *K. erecta* is on specialist bees for pollination and fruit set. We would particularly like to know to what degree there is redundancy in the pollination system of this native grassland shrub. Redundancy in the system - for example, the ability to self-pollinate or be effectively pollinated by multiple bee taxa - could buffer *K. erecta* populations against disturbances such as variability or decline of local populations of one or more pollinators.”

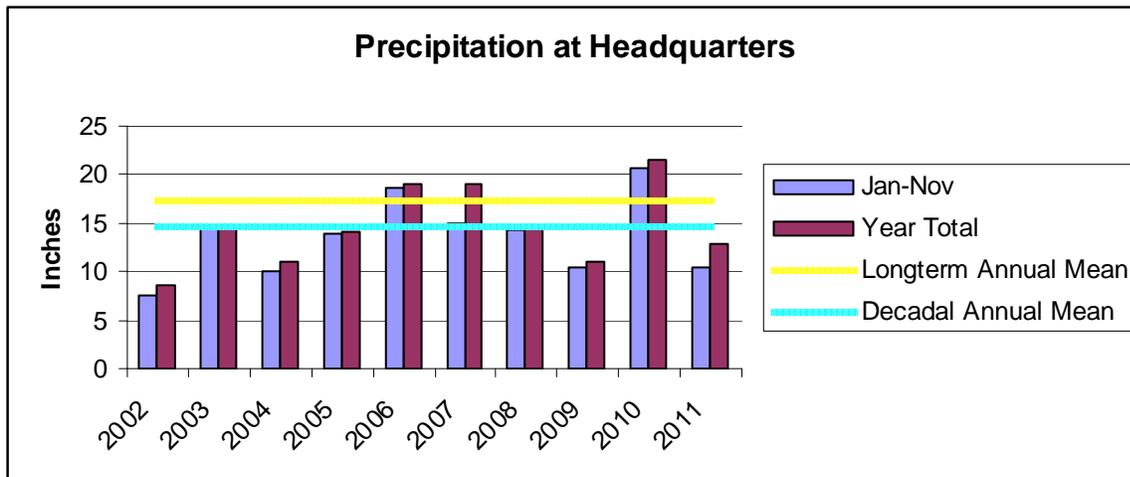


Laura Williams (above) and Deborah Finke, University of Missouri

Monitoring

Water, water everywhere...

Well, not exactly! Even with an unusual storm in December that brought over 2” of rainfall, the yearly total is well below the long-term average annual precipitation of 17.5.” 2011 was even drier than an average based on the past ten years!



The Research Ranch is participating in a large scale precipitation monitoring effort organized by SAHRA and the Arizona Cooperative Extension. You, too, can help scientists by contributing your precipitation data – check out <http://rainlog.org>.

In addition to the gage at Headquarters and gages at vegetation monitoring plots, USDA-ARS maintains several stations that record precipitation, temperature, soil temperature and other variables. Links to these data are available on the Research Ranch website. The

National Oceanographic and Atmospheric Administration has maintained a Climate Reference Network station just west headquarters for several years. In 2011 this station was updated and now includes a video camera for live streaming along with temperatures, wind speed, precipitation, solar radiation, and other variables. Scientists all over the world access this information; see, for example, Chen, et al., Krishnan, et al., Kumar & Ruddel on pgs. 17-19.

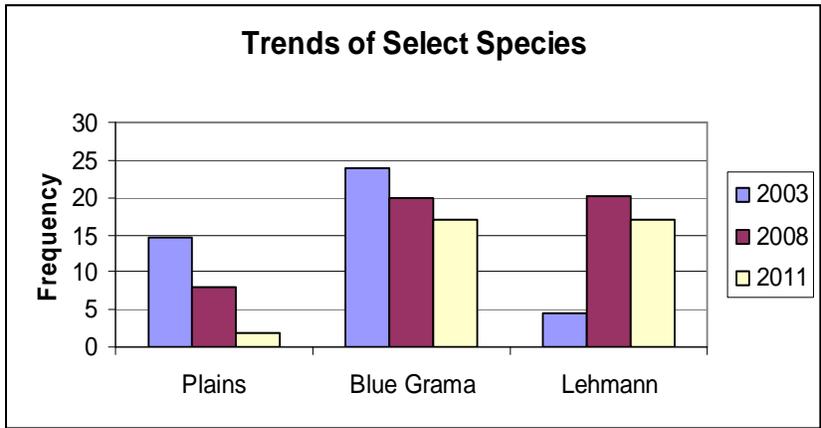
Vegetation

A grant awarded to the Coronado RC & D from the Arizona Water Protection Fund for research and monitoring of the Babacomari watershed provided a new herbarium case so we can expand our collection efforts to include plant species from the region. This will enhance the Research Ranch’s role as a resource for scientists and land managers.

This fall, with the help of volunteers Jim Koweek and Dan Robinett, we completed all eighteen pace frequency transects at ecological sites across the Research Ranch. A summary of the results of the first 9 years of this effort (2003-2011) was presented at the Las Cienegas fall biological planning meeting and can be found in the library on the Research Ranch website. A poster will be presented at the Society for Range Management Annual Meeting in Spokane. Results show the mean species richness per transect to be 96.7 with a total species richness of 247 on all transects.



Species Richness at All Transects						
RR Tag No.	Woody/Succulent	Grasses	Forbs	Total Species Richness	Ecological Site	Location
660	8	13	37	58	Loamy Upland	S of Finley Tank (Boer)
771	7	20	42	69	Loamy Upland	East Mesa, USFS s of RR gate
658	7	26	45	78	Loamy Hills	E side of Bald Hill, east facing
659	9	24	47	80	Limey Slope	S of McDaniel Well, south facing
665	12	29	44	85	Loamy Upland	East of O'Donnell, near FS fence
661	9	24	61	94	Loamy Upland	East Mesa, N or road to Diamond C
675	9	31	57	97	Loamy Upland	NW of Vaughn
772	11	27	60	98	Loamy Slope	S of Cimarron road, east facing
663	12	26	61	99	Loamy Slope	W side of Bald Hill, south facing
651	7	25	69	101	Loamy Upland	West Mesa
706	10	23	69	102	Loamy Upland	East Mesa, ARS site
652	5	30	70	105	Sandy Loam Upland	S of Ranch House
653	11	27	68	106	Loamy Slope	East Mesa, west facing
650	7	25	75	107	Loamy Upland	Post Canyon, ARS site
655	14	35	58	107	Limey Slope	East Mesa, south facing
656	6	29	74	109	Loamy Bottom Swales	N of Pronghorn Well
664	16	29	69	114	Loamy Slope	W side of Bald Hill, north facing
666	15	33	84	132	Shallow Hills	W of O'Donnell, east facing
Mean	9.7	26.4	60.6	96.7		



Not all transects have been read each year, but the graph to the left shows some trends apparent in the years when all transects were completed. Two iconic native grasses, Plains Lovegrass and Blue Grama exhibited a steady decline in frequency and the trend for the non-native, Lehmann Lovegrass is upward.

Birds

The 5th Appleton-Whittell Christmas Bird Count for 2010 was conducted on January 2, 2011. Twenty-nine participants recorded 5,037 individuals within 98 species; fewer species but more birds than the 2009 CBC! Our count made the Tucson news as Sam Salswadel, Channel 13 news, accompanied one of the teams and interviewed Robert Weissler, the compiler for the Appleton-Whittell CBC.



Results of the 2011 CBC, held Dec 31, are still being tallied but the volunteers and the birds enjoyed the beautiful weather! Robert Weissler, compiler for this circle, will post the results at <http://www.huachuca-audubon.org/CBC/AWCBC.php>.

Herpetiles (Reptiles and Amphibians)

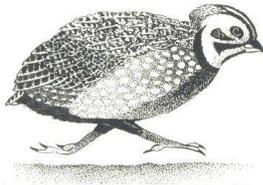


This year Roger Cogan, Conservation Coordinator, picked up the challenge of re-documenting and verifying reptiles and amphibians of the Research Ranch. "There is a rich diversity of amphibian and reptile species that occur or are thought to occur at the Research Ranch. Over the years there have been fifty-one species of amphibians and reptiles identified within the preserve. Several species have not been seen in the last few years and may no longer occur here. Our challenge into the future is to safeguard the continued existence of those that are still found here and to work towards returning those that may have disappeared."

Roger's work has been shared through a scientific poster at the Science on the Sonoita Plain symposium and abstracts have been submitted to the Madrean Conference to be held in May. Check out the updated checklist and fascinating report on rattlesnake den sites on the Research Ranch library website: <http://researchranch.audubon.org/Library.html>.

To see a complete list of active research and monitoring projects and publications associated with the Research Ranch, see pages 17 through 25 of this report.

OUTREACH and EDUCATION



Living Gently on the Land

Our “Potlucks & Presentations” educational series for 2011 started out with Lois Albrecht’s “Overview of the Tallgrass Prairie,” followed by a presentation on Permaculture by Kate Tirion in February. Former intern Erika Geiger spoke of her post-doctoral studies in the “Savannas of the Americas: From Arid Arizona to Tropical Brazil” and Trevor Hare, of Sky Island Alliance, shared methods of erosion control that we can all use. Roger Cogan, Conservation Coordinator, gave an excellent presentation on the reptiles and amphibians of the Research Ranch. We all enjoyed Ron Pulliam’s talk on “Ecology of Grassland Birds: avoiding predators while finding food.” One of the most beautiful presentations came from Priscilla and Hank Brodtkin as they shared “Butterflies for Birders – Emphasis on Southeast Arizona Butterflies.” Mark Stromberg and Ward Brady entertained us with their memories of “The Research Ranch, Back Then!”

If you’re not on our e-list already, contact us at researchranch@audubon.org or check our website for upcoming events. Pat has developed a great schedule for 2012!

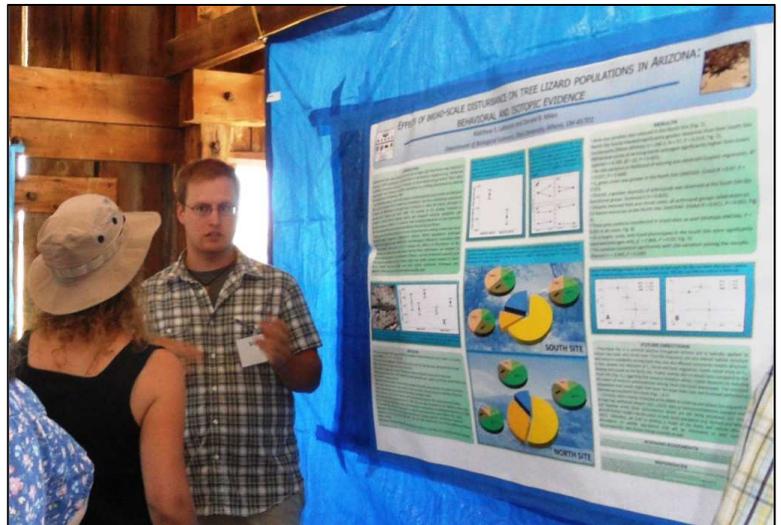
Science on the Sonoita Plain

The 3rd annual science symposium, a quarterly meeting of the Sonoita Valley Planning Partnership, was again held at the Research Ranch in June. Over 90 participants registered for the event to see regionally relevant presentations and posters shared by scientists such as Matt Lattanzio, at right, who is a doctoral student from Ohio University.

2011 marked the 25th anniversary since the signing of the Cooperative Agreement between the Bureau of Land Management (BLM) and Audubon that outlined the collaborative effort to manage public lands administered by the BLM within the Research Ranch. Tom Dabbs, BLM Gila District Manager, introduced some of the key players that made this agreement possible: Dean Bibbes and Henri Bisson, former Arizona BLM State Directors, and Glendon Collins, formerly with the Arizona State Land Department and BLM. History came alive as these men shared their memories of the challenges and rewards when land swaps between federal and state agencies were used to conserve large tracts of land such as the one that brought the BLM into the Research Ranch partnership. See pages 26-29 of this report for a summary of the results of this partnership.

Coffee and light refreshments were provided by the Cienega Watershed Partnership for attendees of the symposium. Resolution Copper Company (another Research Ranch partner) provided funding for the lunch served in the barn as well as support for development of the proceedings of the symposium, which is available on our website:

<http://researchranch.audubon.org>.



Energy Exposition

This year the Expo, sponsored jointly by the Sonoita Crossroads Community Forum and the Research Ranch with financial support from TogetherGreen, an alliance between Toyota and Audubon, was held at the Elgin School and added a new attraction—a scientific poster contest open to area students K-12.



Trophies were awarded in five categories:

Scientist of Tomorrow (sponsored by National Audubon Society)

1st: Hannah Eaton (Gr 8) 2nd: Alex Scheid (Gr 5) 3rd: Susan Daus (Gr 6)

Energy (sponsored by Practical Energy for Rural Communities)

1st: Tony Ewing (Gr 6) 2nd: Garrett Fish (Gr 7) 3rd: Carolina Quiroz (Gr 2)

Leadership and Innovation (sponsored by the Mountain Empire Rotary)

1st: Jorge Rocha (Gr 7) 2nd: Anthony Lopez (Gr 8) 3rd: Sid Skiver (Gr 7)

Peoples's Choice (Sponsored by the Sonoita Crossroads Community Forum)

1st: Ana Mata (Gr 6) 2nd: Luis Agosttini (Gr 7) 3rd: Mariana Rosas (Gr 8)

Vendor's Choice (sponsored by Together Green)

1st: Toni Valasquez (Gr 7) 2nd: Aileen Beltran (Gr 6) 3rd: Marin Tomlinson (Gr 3)

The next Expo is scheduled for March 17, 2012, and will be expanded to include more aspects of sustainability which is reflected in the new name:

Sustainable Living In the Mountain Empire!

So mark your calendar and stay tuned for more updates!

<http://sites.google.com/site/sustainablime/home>

RISE Symposium

“What good is a ranch if you don’t raise cows?” was the question posed and answered by Linda Kennedy, one of the invited speakers at the 8th annual **Research Insights in Semiarid Ecosystems** symposium held at the University of Arizona on October 29. Among other interesting facts that emerged from the presentations was the acknowledgement that the Research Ranch has been studied extensively and supports a rich diversity of species. According to Mitch McClaran, Ph.D., U of A, the flora of the Santa Rita Experimental Range is reported to be 468 species, which equates to 5.6 per square mile. By comparison, the published flora of the Research Ranch includes 586 species, or 45 per square mile! To see the slide presentations at the symposium, please visit <http://www.tucson.ars.ag.gov/rise/index.htm>.

Field Trips

Several groups toured the Research Ranch in 2011, including members of the Cochise and Tucson chapters of the Arizona Native Plant Society who expanded their plant I.D. skills through our “Grass Identification 101” workshop (photo at right). Other groups included the Arizona Antelope Foundation, The Research Ranch Foundation and Mrs. Koweek’s 7 grade science class from Elgin School. The students enjoyed learning about the grasslands, water resources and the animals that rely on grasslands for survival.



Staff Participation: In addition to on site activities, Audubon personnel have been active in large scale research and conservation activities including the Climate Change Adaptation in Arid Southwest effort based in Tucson, the International Rangeland Congress in Rosario, Argentina, the Upper San Pedro Partnership, and Audubon’s Western Rivers Initiative.

Fiscal Situation

Fiscal year 2010/2011 was a challenge (see below) but things are looking up for FY 2011/12! Although the distribution from the endowment is still lagging, the Research Ranch received **\$78,333.89** in calendar year 2011 through grants, contributions and bequests! The generosity of our friends is allowing us to take care of some deferred maintenance issues and we're using some of this windfall to upgrade the housing facilities for our researchers! One very generous donor, who wishes to remain anonymous, explained her gift, "The Research Ranch has been in my will for many years, but I just decided that there was no reason to wait – you might as well have the money now!" We've earmarked her gift toward installation of a heating system in the Ranch House so that building can be used year-round.

Appleton-Whittell Research Ranch		
Budget FY 10/11 Ending June 30, 2011		
Revenue	Contributions	7690
	Grants	16817
	Rentals	5920
	Misc Income	6024
	Pooled Investment	215316
	Assets Released	714
	Total Revenue	252481
Expenses	Salaries/Benefits	147,007
	Staff training	685
	Travel	185
	Vehicle oper	1814
	Postage-General	162
	Professional & Consultant	14442
	Gas & Electricity	3571
	Buildings, Maintenance	7142
	Telephone/Telecommunications	4711
	Rent	336
	Insurance	8237
	Maintenance	10306
	Office & Household Supplies	3584
	Educational Materials	20
	Furniture & Fixtures	1694
	Computer/Software	2913
	Research Equip	303
	Photographic Supplies	251
	Farm Supplies	1666
	ADV- general	706
	License, permit, registration	108
	Dues & Subscriptions	170
	Other	19
	Depreciation	2338
	Trans to Carryover	10,778
	Support Service Allocation	29333
	Total Expenses	252,481

Publications associated with the Research Ranch Received in 2011

- Allington, G. R. H. and T. J. Valone (2011). Long-term Livestock Exclusion in an Arid Grassland Alters Vegetation and Soil. Rangeland Ecology and Management **64**(4): 5.
- Allington, G. R. H., T. J. Valone, et al. (2011). Islands of Fertility: An Artifact of Grazing? (Poster). Science on the Sonoita Plain. Appleton-Whittell Research Ranch, Elgin, AZ: Poster.
- Bock, C. E., Z. F. Jones, et al. (2011). Response of Rodents to Wildfire and Livestock Grazing in an Arizona Desert Grassland. The American Midland Naturalist **166**(1): 126-138.
- Bodner, G., L. Kennedy, K. Simms, J. Williamson. (2011). Proceedings of the 3rd Annual Science on the Sonoita Plain Symposium. 21 p.
<http://researchranch.audubon.org/PDFs/2011-ScienceOnSonoitaPlain.pdf>
- Carrillo, N. (2011). Accomplishment Report: Desert pupfish released at Audubon Research Ranch. Tucson, AZ, US Fish and Wildlife Service Aquatic Animal Recovery Group Arizona Game & Fish.
- Chappell, J., M. Hughes, et al. (2011). Relevance of Communication in Disturbed vs. Undisturbed Environments (Poster Summary). Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch: Poster Summary.
- Chen, Y., K. Yang, D. Zhou, J. Quin, X. Guo. (2010). Improving the Noah Land Surface Model in Arid Regions with an Appropriate Parameterization of the Thermal Roughness Length. Journal of Hydrometeorology **11**:995-1006.
- Cogan, R. C. (2011). Herpetofauna at the Appleton-Whittell Research Ranch of the National Audubon Society. Science on the Sonoita Plain Quarterly Meeting of Sonoita Valley Planning Partnership, Elgin, AZ, AWRR.
- Donaldson-Matasci, M. and A. Dornhaus (2011). Collective Foraging and Communication in Honey Bees: How Habitat Affects the Benefit of Dancing. Animal Behavior Society Meeting. Indiana University, Bloomington, Indiana.
- Donaldson-Matasci, M. C. and A. Dornhaus (2011). The benefits of communication in honeybees depend on ecological context. Ecological Society of America Annual Meeting. Austin Convention Center, Austin, TX.
- Donaldson-Matasci, M. C. and A. Dornhaus (2011). The Value of Honeybee Communication in Five Sonoran Desert Region Habitats. Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Poster/Poster Summary.
- d'Orgeix, C. A., T. Mathies, et al. (2011). Slevin's Bunchgrass lizard (*Sceloporus slevini*) Population Barely Extant on the Sonoita Plain, Arizona. Herpetological Review: 166-169.

- Geiger, E., L. Kennedy, et al. (2011). Additions to the Flora of the Research Ranch (Poster and abstract/summary). Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Poster/Abstract/Summary.
- Geiger, E. L., L. J. Kennedy, et al. (2011). Additions to the Flora of the Appleton-Whittell Research Ranch, Northeastern Santa Cruz County, Arizona. Journal of the Arizona-Nevada Academy of Science **43**(1): 12-15.
- Kennedy, L. (2011). 25 Years of Science and Management Cooperation - BLM and Audubon. Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Presentation.
- Kennedy, L. (2012). Vegetation Monitoring on an 8000 acre Exclosure Poster/ Presentation. Society for Range Management Annual Meeting. Spokane, WA. Abstract, Poster.
- Krishnan, P., T.P. Meyers, R.L. Scott, L. Kennedy, M. Heuer. (2011). Energy exchange and evapotranspiration over two temperate semi-arid grasslands in North America. Agricultural and Forest Meteorology. In Press.
<http://dx.doi.org/10.1016/j.agrformet.2011.09.017>
- Krishnan, P., T.P. Meyers, R.L. Scott, L. Kennedy, M. Heuer. (2011). Interannual variability in energy exchange and evapotranspiration over two semi-arid grasslands in Arizona. Poster presented at American Geophysical Union Fall Meeting, Dec 5-9, San Francisco.
- Kumar, P. and B. L. Ruddell (2010). Information Driven Ecohydrologic Self-Organization. Entropy **12**(12): 2085-2096.
- Lattanzio, M. S. and D. B. Miles (2011). Effects of Broad-Scale Disturbance on Tree Lizard Populations in Arizona: Behavioral and Isotopic Evidence. Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Poster/Summary.
- McFarlin, S., A. Bunting, et al. (2011). "Back Then" Enriching our understanding of the watershed through their stories (Presentation). Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Presentation/Summary.
- Narina, S. S., C. A. d'Orgeix, et al. (2011). Optimization of PCR conditions to amplify microsatellite loci in the bunchgrass lizard (*Sceloporus slevini*) genomic DNA. BMC Research Notes 2011 **4**:26, pgs 1-6. doi:10.1186/1756-0500-4-26
- Porter, W.E. (2011). Renewable Energy in Rural Southeastern Arizona: Decision Factors: A comparison of the Consumer Profiles of Homeowners Who Purchased Renewable Energy Systems With Those Who Performed Other Home Upgrades or Remodeling Projects. Thesis. Arizona State University. 177 pps.
- Porter, W. E. (2011). Renewable Energy in Southeastern Arizona: Decision Factors (Poster). Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Poster and Summary.

- Robinett, D. (2011). Babacomari River Riparian Protection Project (Poster). Science on the Sonoita Plain Quarterly Meeting of the Sonoita Valley Planning Partnership. Appleton-Whittell Research Ranch, Elgin, AZ: Poster/Summary.
- Robinett, D. (2012). Babacomari River Riparian Protection Project, Poster Presentation. Society for Range Management Annual Meeting. Spokane, WA.
- Tang, R., Z.-L. Li, et al. (2011). Validating MODIS-derived land surface evapotranspiration with in situ measurements at two AmeriFlux sites in a semiarid region. Journal of Geophysical Research **116**(D04106): 14.
- Thompson, S.E., C.J. Harman, A.G. Konings, M. Sivapalan, A. Neal, P.A. Troch. (2011) Comparative hydrology across AmeriFlux sites: The variable roles of climate, vegetation, and groundwater. Water Resources Research **47**: W00J07, doi:10.1029/2010WR009797, 2011
- Weglarz, K.M., C.R. Bartlett. (2011). *Akemetopon*, a new genus containing three new species of planthoppers (Hemiptera: Fulgoroidea: Delphacidae). Zootaxa **3007**:50-60
- Wheeler, A. G., Jr. (2011) *Arhyssus confusus* Chopra and *A. Parvicornis* (Signoret) (Hemiptera: Rhopalidae): Apparent Specialists on Globemallow (*Sphaeralcea* Spp.; Malvaceae), with Notes on their Seasonality. Proceedings of the Entomological Society of Washington, **113**(2): 195-202.



Active Research/Baseline Projects – 2011

Active: One or more of following: Proposal approved but project not commenced; Field work/research within past two years; Publication received within past two years; Publications pending; Publications in demand within past two years; Projects with return intervals >1 year; Collaborative, long term efforts.

- Denotes projects with field work conducted at the Research Ranch during 2011

Investigating the effect of livestock on the physical properties of soil in an arid grassland

Allington, Ginger; Thomas J. Valone; Saint Louis University. St. Louis, Mo

Subject: Collect water infiltration and soil compaction data on grazed and ungrazed land

Application: Evidence of impacts of livestock on physical properties may assist restoration efforts at desertified sites.

Survey results for mule deer, javelina and whitetail deer on the Research Ranch

Arizona Game & Fish Department; Tucson, AZ

Project: Estimate populations

Application: Analyze impacts of hunting, climate on populations

Leopard frog surveys

Arizona Game & Fish Dept. (AZGF): Phoenix, Arizona

Subject: Survey leopard frogs, primarily in Post Canyon area

Application: Protect native species

Native Fish Reintroduction in Turkey Creek

Arizona Game & Fish Dept. (AZGF), Tucson, AZ

Subject: Reintroduce Gila chub, longfin dace into Turkey Creek on Steen's property. Potential to spread into Research Ranch.

Application: Protect listed species

***Fish Surveys**

Arizona Game and Fish Department and Bureau of Land Management. Fisheries biologists

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

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

***Pupfish**

Arizona Game & Fish Dept. (AZGF) Ross Timmons, Phoenix, Arizona

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

Application: Conserve native species

***Survey of Gould's Turkeys near Huachuca Mountains**

Arizona Game & Fish Department; Tucson, AZ

Project: Estimate populations

Application: Track success of re-introduction effort

***Avian Monitoring for Research Ranch IBA**

Audubon staff: Tice Supplee, L Kennedy

Project: Establish transects to monitor bird species on ARR

Application: Support IBA nomination, examine longterm trends

***Bullfrogs, Monitoring and Treatment on the Research Ranch**

Audubon Staff: L. Kennedy, R. Cogan

Subject: Discover and eradicate individuals within boundary of ARR

Application: Protect native fish, reptiles and amphibians from predatory, non-native species

***Christmas Bird Count – Appleton Whittell Circle**

Audubon staff; Robert Wessler (Huachuca Audubon Society) – organizer and compiler

Subject: Conduct bird count as per Audubon standards.

Application: Pooled data yield important information re avian populations, movement and trends.

***Depth to groundwater on Research Ranch**

Audubon Staff; Sandy and Betsy Kunzer, volunteers

Project: Monitor the depth to groundwater of the wells on Research Ranch.

Application: This study helps establish a water consumption baseline for the Sonoita Valley.

***Ecological Site Monitoring (ESM)**

Audubon Staff– Linda Kennedy

Project: Establish permanent points to monitor vegetation change. Based on Ecological Site Map

Application: Identify trends in vegetation change

***Geographic Information System**

Audubon Staff

Project: Create maps to document ecological factors, infrastructure and research locations

- Application: Archival information to assist in land management and research
- *Herpetological communities on the Research Ranch**
Audubon Staff – Roger Cogan
Project: Document present or absence of reptile and amphibian species, with emphasis on habitat
Application: Archival information
 - *Precipitation at Ecological Sites**
Audubon Staff – Linda Kennedy
Project: Establish range gages to correspond with ESM. Based on Ecological Site Map
Application: Correlate precipitation with changes in vegetation.
 - *Rodent populations on the Appleton-Whittell Research Ranch**
Lapidus, Sarah. (Intern), Amherst; and L.J. Kennedy
Project: Develop long-term monitoring program based on Jones, Bock and Kennedy
Applicability: Indicate trends in small mammal populations
 - *Wild Turkeys on the Research Ranch**
Audubon Staff; Roger Cogan
Project: Record sightings of wild turkeys.
Application: Document spread of sub-species reintroduced in Huachuca Mtns.
- Subdivision versus ranching: Effects of livestock grazing and exurban development on the biodiversity of a southwestern grassland/savanna**
Bock, Carl , Jane Bock, University of Colorado
Subject: The impacts of conversion of ranches into housing developments.
Application: Guide human population growth to minimize negative impacts on native species.
- *Response of rodents, birds, and vegetation to the Ryan Fire, Sonoita Valley, AZ -a unique opportunity to examine the ecological consequences of fire in grassland/savannas of the Arizona Borderlands**
Bock, Carl, E., University of Colorado Linda J. Kennedy, Audubon
Subject: Quantify effects of wildfire on assemblages of small mammals, birds and vegetation.
Application: Help land managers predict response of species to large scale rangeland fire
- Soil inventory update**
Breckenfeld, Donald J., Daniel Robinett; U.S.D.A. N.R.C.S.
Project: A soil inventory update that coincides with soil surveys that have been done elsewhere in s. Arizona
Application: Baseline information needed by other research projects.
- Renewable energy options for Southern Arizona**
Burand, Rachel, Intern, and Linda Kennedy, Audubon
Project: Develop educational material outlining alternatives to electricity generated from coal
Application: Assist residents and business owners reduce carbon emissions
- *Population dynamics and habitat characteristics of Montezuma (Mearn's) Quail in southeastern Arizona**
Chavarria, Pedro Mazier; Texas A & M University, and Louis Harveston, Ph.D., Sul Ross State University,
Subject: Monitoring movement of quail.
Application: Fill knowledge gaps about life history and determine how behavior and genetic viability is affected in areas where hunting is, and is not, allowed.
- A History of the Lands in the National Audubon Society's Research Ranch Near Elgin, in Santa Cruz County, Arizona**
Collins, Glendon E., Bureau of Land Management (retired), Arizona State Trust Lands (retired). Phoenix.
Subject: Compile and document history of land transactions involving federal and state lands.
Application: Background and archival information
- Boer Lovegrass on the Research Ranch: Update 2008**
Crawford, David. (Intern). University of Iowa, Iowa City IA.
Subject: Use GPS and GIS to map locations of Boer Lovegrass (*Eragrostis curvula* var. *conferta*) on the Research Ranch
Application: Compare with previous work to assess trends. Provide time specific information re spread.
- *Using soil moisture to assess ecosystem function following exotic lovegrass invasion in semiarid grasslands of southeastern Arizona**
Cross Anne F., Ph.D., Tulsa OK Alexander G. Fernald, Ph.D., New Mexico State University
Project: Measure soil moisture under Plains lovegrass (*Eragrostis intermedia*), a native species, and Lehmann lovegrass (*E. lehmanniana*), an exotic species.
Application: Determine whether a semiarid grassland retains its functional integrity following the invasion of an introduced grass.
- *Cataloging the Biodiversity of the Research Ranch**
Dean, Virginia., Volunteer. Elgin, AZ.
Project: Compile and standardize information on known taxa into Excel spreadsheets.
Application: Centralize information for ease in exchange and to highlight data gaps.
 - *Honeybee communication and the ecological context**

Donaldson-Matasci, Matina. Dept. of Ecology & Evolutionary Biology, University of Arizona
Project: Explore relationship between resource distribution and value of communication.
Application: Basic science on species

***Current Distribution and Status of Slevin's Bunchgrass Lizard, *Sceloporus slevini*, in southeastern Arizona**
d'Orgeix, Christian, Ph.D. Virginia State University.

Project: Survey for bunchgrass lizard. Collect tissue for DNA analysis (tip of tail – no take) to compare intrapopulation and interpopulation genetic variance.

Application: foundation for determining genetic relatedness of different populations and effects of bottlenecks on populations

***Survey of Appleton-Whittell Research Ranch Drainages and Ponds for the Mexican Garter Snake**

d'Orgeix, Christian, Ph.D. Virginia State University

Project: Survey for presence of Mexican garter snakes (Telles tank, O'Donnell Canyon, Post Canyon), and conduct long-term study of population at Finley tank.

Application: Management implications for species of special concern (AZGF)

Annotated bibliography of selected reports, publications and theses

Dyson Ruth E., volunteer, Mason, Mi.

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

Application: Facilitate information exchange and document publications

Microsatellite DNA survey of desert pupfish

Echelle, Anthony A., Oklahoma State University,

Project: Assess genetic status of desert pupfish refugium populations and develop management protocols for exchange of genetic material among populations.

Application: A conservation genetics protocol will be developed for long-term maintenance of desert pupfish populations.

***Merging functional ecology and phylogenetics to predict the response of grasslands to global change**

Forrestel, Elisabeth, Melinda Smith, Ph.D., Yale University.

Project: Compare natural grassland sites across broad precipitation gradients in North America, Australia and South Africa.

Application: Provide evolutionary history and functional biology of ecologically and economically important grass species here.

Finding effective strategies for adding native diversity into heavily invaded grasslands

Fehmi, J.S., Ph.D., 530 621 7268. jfehmi@email.arizona.edu; U of A; SNR, Tucson

Project: RE-introduce native plants into areas dominated by naturalized, non-native plants

Application: Increase proportion of palatable native plants

Survey of high desert grasslands Hymenoptera

Grissell, Eric, Sonoita, AZ

Project: Study insect diversity in southwest

Application: Significant contribution to state of knowledge

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

Hass, C.C., Borderland Carnivore Studies, Vail, AZ.

Project: Use trail cameras to identify and monitor various species of terrestrial wildlife.

Application: Identify habitat specific wildlife use and develop index for long-term trends.

Introduction of Species Diversity into Boer Lovegrass Monocultures

Hershendorfer, Mary, Heather Dial, Ramona Gardner, Ph.D., USDA-NRCS Plant Materials Center. Tucson

Project: Determine effectiveness of various methods to increase native biodiversity into monoculture created by non-native lovegrass.

Application: Protect native grasslands

***Meteorological Station**

Keefer Tim, Hydrologist, USDA-ARS; Southwest Watershed Research Center; Tucson, AZ

Project: Station jointly owned by RR & USDA

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

***Monitoring the effects of fire on semi-arid grassland and oak savannas after decades of fire suppression**

Kennedy Linda, Ph.D., Audubon

Project: Monitor the effects of prescribed burns and wildfire

Application: Baseline information for future research

***Photo-herbarium for the Research Ranch**

Kennedy Linda, Ph.D., Audubon

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

Application: Baseline information for future research; Aids identification.

***Sacaton Rehabilitation**

Kennedy Linda, Ph.D. Research Ranch

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

- Application: Improve wildlife habitat, bioremediation of sites dominated by exotic, invasive Bermudagrass.
- *Modeling impacts of habitat alterations on habitat use and diet selection of desert reptile communities**
Lattanzio, Matthew S., Ohio University.
Project: Determine how management practices and climatic variability affect resource availability and use by grassland reptiles
Application: Management practices may be altered to enhance habitat and use
- Recommendations on Sustainability - Housing**
Lundgren, Erick, Intern, Audubon
Project: Develop plan to upgrade buildings for sustainable energy use.
Application: Conserve energy
- *Flora of the Appleton-Whittell Research Ranch**
McLaughlin Steven P., Ph.D., University of Arizona, (Ret.), Erika L. Geiger, Ph.D; USGS ; Janice E. Bowers; USGS (Ret); Linda Kennedy, Ph.D., Audubon
Key words: flora, floristic elements, grasslands, vascular plants
Application: Baseline for ongoing and future research
- Natural Resources Inventory – Primary Site Unit**
Natural Resources Conservation Service – USDA. Tucson, AZ.
Project: Repeated measures: vegetation and soil. Transects established in 1982, to be resampled on approximately decadal basis.
Application: Identification of trends – reference area for MLRa-41
- *Long-term meteorological, evaporation and carbon flux measurements**
National Oceanic & Atmospheric Administration (NOAA); Tilden P. Meyers, Ph.D. NOAA, Oak Ridge, Tn
John Hughes, NOAA, National Data Climatic Center, Ashville, NC
Subject: Establish a Climate Reference Network site – to characterize the water and carbon balance for typical ecosystem for arid southwest grasslands.
Application: These data will be used to improve the current land use models for climate change.
- The Effects of Fire and Grazing on Grassland Bird Diversity and Abundance in an Arizona Oak-Savanna**
Nichols, Clay. Eastern New Mexico University, Portales, New Mexico
Project: Re-survey bird diversity on oak transects established by Bock & Bishop after Ryan fire.
Application: Provide information, long-term, on effect of wildfire on avian diversity and abundance
- * Pre-monsoon post-fire sediment survey**
Nichols Mary, Ph.D., Hydraulic Engineer, USDA-ARS; Tucson, AZ
Subject: Survey several stock tanks on ARR to determine level of sediment movement after monsoon and evaluate transpiration and evapotranspiration
Application: Evaluate factors in rangeland health post fires.
- Impacts of grazing, fire and precipitation variability on woody plant cover in Chihuahuan Desert grasslands, USA**
O'Neal, Kelley. University of Maryland, College Park, MD
Project: Quantify changes in woody plant cover, map occurrence of grazing, fire and precipitation using (in part) Landsat and MODIS satellite data
Application: Identify trends, develop methodology
- *TogetherGreen Apacheria Renewable Energy Analysis**
Porter, Wayne. Arizona State University School of Sustainability, Tempe, AZ
Project: Develop a replicable methodology for characterizing, and also disseminating information about the available renewable energy resources.
Applicability: Analyze methodologies by which to reduce carbon emissions
- Identification of bobcats using photos from trail cameras**
Reifel, Lindsey (Intern) and C.C. Hass
Project: Determine identifiable characteristics on peltage of bobcats (*Lynx rufous*)
Application: Monitor number and movement of bobcats on Research Ranch
- *Species boundaries and phylogeography of the dwarf milkweed group**
Riser, James P., II, School of biological Sciences, Washington State University, Pullman, WA.
Project: Collect leaf tissue from *Asclepias uncialis* for DNA analysis
Application: Determine species boundaries and taxonomic status
- Inventory of ecological sites, their present day condition, trend and rangeland health**
Robinett Dan, Don Breckenfeld, both retired from U.S.D.A. –N.R.C.S. Tucson, AZ
Project: Mapped the ecological sites on ARR and compared present day plant communities to what our site guides show as potential for MLRA 41.
Application: Baseline information for future research and land management. Control area for comparison by ranch managers.
- *Babocomari River Protection**
Robinett, Daniel G., Robinett Rangeland Resources, Catalina, AZ; Donna Mathews, Coronado RD & D., Inc.

Willcox, AZ.

Project: Establish transects and monitor streamside conditions of Babocomari River, O'Donnell and Turkey Creek for 5 years .

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

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

Ruth, Janet M. Ph.D., USGS Arid Lands Field Station, Fort Collins Science Center, Department of Biology, University of New Mexico, Albuquerque, NM

Project: Compare pre-fire data collected on the Audubon Appleton-Whittell Research Ranch in 1999-2001 with post-fire data collected on the same transects and plots.

Application: Evaluate the effect of wild fire on wintering avian abundance/densities and vegetation structure/composition in desert grassland habitats.

***Wintering habitat use by priority grassland birds**

Ruth, Janet M. Ph.D., Research Ecologist, USGS Fort Collins Science Center, Arid Lands Field Station, Department of Biology, University of New Mexico, Albuquerque, NM

Project: How do high priority grassland birds use habitats during the winter season? How is winter habitat use affected by land use practices such as grazing?

Application: Aid in land management decisions to provide habitat.

***Distribution and abundance of breeding Arizona Grasshopper Sparrow (*Ammodramus savannarum amolegus*), and associated priority grassland species, throughout its known range in the Southwest U.S.**

Ruth, Janet M. Ph.D., Research Ecologist, USGS Fort Collins Science Center, Arid Lands Field Station, Department of Biology, University of New Mexico, Albuquerque, NM 87131

Project: Document current distribution and abundance of Arizona Grasshopper Sparrows and associated priority grassland bird species. Test methodologies.

Application: Understanding status and distribution, population trends, ecology and habitat relationships is essential for conservation of avian species of concern.

***Preliminary mapping of archaeological sites revealed after Ryan Wildfire**

Schupp Leslie, Patagonia AZ

Project: Map archaeological sites between headquarters and research housing post Ryan fire. Record with state.

Application: Establish permanent record.

***Assessing Condition of O'Donnell Creek**

Simms, Jeffrey, BLM Fish Biologist, Tucson Field Office, Nate Dietrich, BLM Hydrologist.

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

Application: Environmental Assessment

The herpetofauna of the Research Ranch

Smith Hobart, Ph.D., University of Colorado, Department of Biology, Boulder, CO David Chiszar, Ph.D., University of Colorado, Department of Psychology, Boulder, CO

Project: Develop a checklist of reptiles and amphibians known or thought to occur on the Research Ranch.

Application: Baseline information

***Ecology of *Sporobolus wrightii* (Big sacaton): Implications for restoration and management of riparian grasslands in southwestern North America**

Tiller Ronald L. (currently TNC) , Brantlee Spakes (UNC) , Juliet C. Stromberg, Jean C. Stutz, Duncan T. Patton; Arizona State University,; Linda Kennedy.

Project: Understand the ecological processes, variables and relationships influencing regeneration and maintenance of sacaton grasslands.

Application: Enhance restoration/revegetation/protection of sacaton grasslands

***Research and reintroduction effort for Huachuca Water Umbel**

Titus Jonathan H., Ph.D., SUNY-Fredonia, Fredonia, NY ; Priscilla Titus, Fredonia NY 14063

Project: Transplant plugs and monitor success

Application: Protect listed species, aid in development of recovery plan for species

Agave Monitoring on the Coronado National Forest

USFS. Sierra Vista Ranger District, Coronado National Forest, Hereford, AZ. Biedenbender, Sharon, Ph.D. and Melinda Castillo.

Project: Monitor impacts of livestock grazing on florivory of agave

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

Chiricahua Leopard Frog Reintroduction to the Research Ranch, a Conservation Strategy

Volentine, Sandy. (Intern) Prescott College, Prescott AZ

Project: Explore opportunities and suitability for reintroduction effort of *Lithobates [Rana] chiricahuensis* to historic habitat

Application: Protect endangered species

***Inventory of Native Plant-Feeding Insects Arizona**

Wheeler, Alfred G., Department of Entomology, Clemson University, Clemson, SC

Project: Collect insects that feed on *Eragrostis* spp. and other plants to identify species, and compare species composition with collections from NM, OK and TX.

Application: Baseline information on species occurrence and host plants

***Pollination ecology of the grassland shrub *Krameria erecta* (littleleaf ratany)**

Williams, Laura and Deborah Finke, University of Missouri, Columbia, MO

Project: Investigation of multiple aspects of *Krameria erecta* pollination biology

Application: Determine dependence of species on native bees

The first 25 years: Summary of the collaborative effort between BLM and Audubon

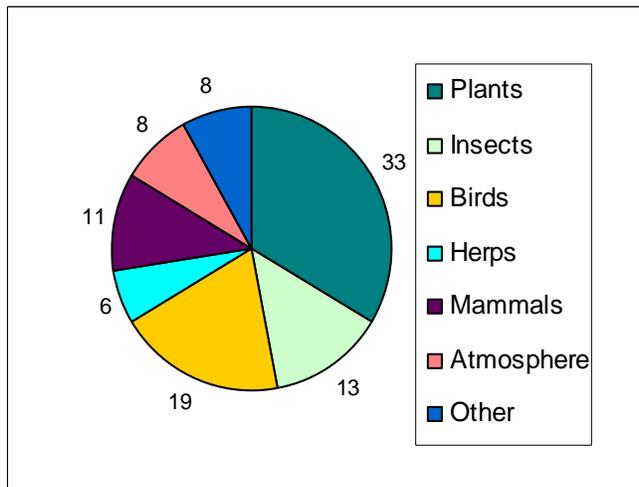
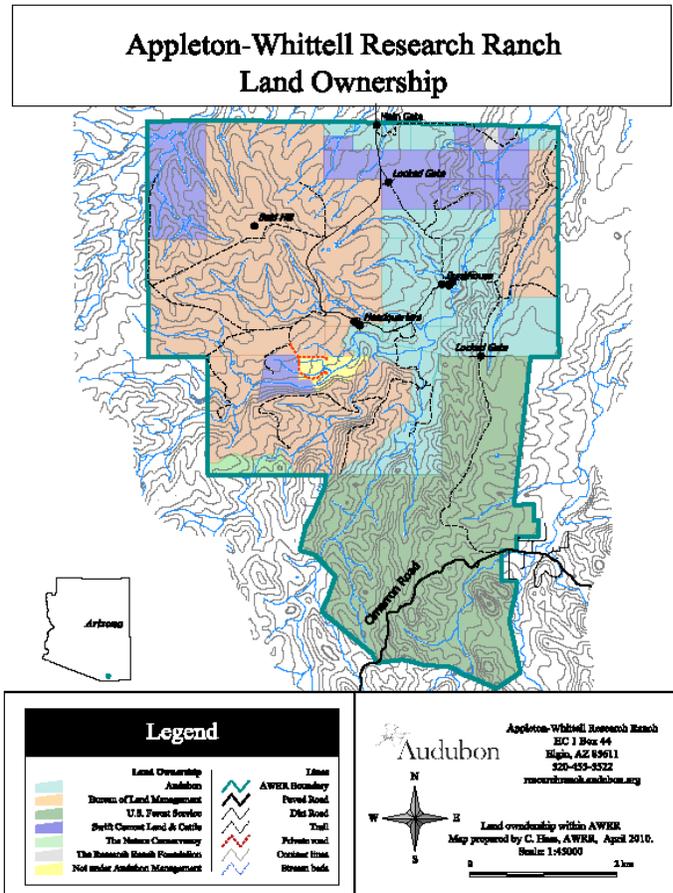
LINDA KENNEDY

On August 8, 1986, Dean Bibbes, Arizona State Director of the Bureau of Land Management (BLM) and Peter Burle, President. of National Audubon Society (NAS) signed a Cooperative Agreement to formalize management of Federally-owned lands administered by BLM within the boundary of the Appleton-Whittell Research Ranch (RR). The management collaboration was further elaborated and strengthened in the Las Cienegas ROD and RMP. The objectives of the Cooperative Agreement are:

- the continuation of on-going research
- the encouragement of future research
- the derivation of mutual benefits from the research
- the protection of the land and its ecological communities from disturbance.

BLM became an active partner in the Research Ranch in part by acquisition of the state trusts land within RR. BLM, thanks to its greater flexibility and authority in resource management, was better able to support long-term research than the state entity. Additional property was added to BLM holdings by direct purchase from Frank Appleton, one of the founders of the Research Ranch, bringing the total acreage of BLM land to 3141 acres (shown in tan on the map to the right).

The relationship between BLM and NAS has enabled dozens of academic, agency and independent scientists to participate in research projects spanning a wide range of topics. An annotated bibliography of peer reviewed papers, theses, dissertations or books publications resulting from studies wholly on in part on the BLM portion of the Research Ranch is available at <http://researchranch.audubon.org/library> (Kugler & Kennedy 2011). The bibliography includes only publications readily available through a university library system, thus reports to or by agencies are not included although these reports are numerous and have provided much insight into grassland ecology and management.



Publications included in the bibliography could be categorized in many ways. The graph at left shows one of the easiest: taxa, atmosphere or other. An equally valid but much more complex categorization could have been based on processes such as fire, exurbanization, drought, or grazing interactions with the various taxa.

The 98 publications included in the bibliography average 4 per year or 1 publication per 31 acres of BLM property, an impressive net return addressing the first two objectives of the Cooperative Agreement. The 3rd objective,

“Derivation of mutual benefits from the research,” is not as easy to enumerate, but examination of selected papers show the studies include many with management implications – along with baseline information that will only become more important with time, As semi-arid grasslands and the species that are reliant upon them for migration, wintering, breeding, or year-round residence are stressed from natural and/or anthropogenic factors, the results of these and ongoing projects will assist land managers to make rational conservation decisions based on sound science. The 4th management objective of the Cooperative Agreement: “the protection of the land and its ecological communities from disturbance” is, in large part, what has made the collaboration between BLM and Audubon so successful in reaching its research objectives. The relevant management objective of the Las Cienegas ROD/RMP: “To cooperate in the research objectives of the Research Ranch” was reinforced by the following management prescriptions:

- Designate an ACEC [Area of Critical Environmental Concern]
- Limit motorized vehicles to designated roads and trails
- Prohibit land use actions except as authorized by Research Ranch
- Do not open to mineral location, leasing, or sales
- Implement 1986 BLM/National Audubon Society MOU
- Prohibit surface occupancy for oil/gas lease development.

These objectives and prescriptions enable the Research Ranch to serve as a control or reference area for many land uses, while allowing management actions to protect the land and its ecological communities.

For this summary, I have included a few excerpts from the bibliography to illustrate the range of scientists, topics, and publication venues. Management implications can be easily derived from many publications.

Taxa: Natural history of individual species is key to protection of species and biodiversity.

Smith, D. 2010. Five New Species of *Acordulecera* Say (Hymenoptera: pergidae) from Arizona and California, the first records of the family from southwestern United States, Washington, D.C., Proc. Entomol. Soc. Wash. 112: 410-422. Five new species of the sawfly family were identified and named, including *Acordulecera whitteli*, which was found on the Research Ranch.

Ruth, J. M. 2008. Distribution and Abundance of Breeding Arizona Grasshopper Sparrow (*Ammodramus Savannarum Ammolegus*) in the Southwestern United States: Past, Present, and Future. Pages 113-124 in C. D. Marti, J. Ruth, T. Brush, and D. Krueper, editors. Birds of US-Mexico Borderlands: Distribution, Ecology, and Conservation. Cooper Ornithological Society. Sonoita and San Rafael Valleys, Arizona and Animas Valley, New Mexico, have the highest numbers of singing males Arizona Grasshopper Sparrows, and the largest populations in the U.S.

Stromberg, Mark R. 2000. Montezuma Quail (*Cyrtonyx montezumae*). in (A. Poole and F. Gill, editors) *The Birds of North America*, No. 524, 2000. The Birds of North America, Inc. Philadelphia, PA. The former director of the Research Ranch wrote the treatment for this species, including distribution, systematics, migration, habitat, food habits, sounds, behavior, breeding, demography and populations, conservation and management, and appearance.

Ortega, J.C. 1990. Home-range Size of Adult Rock Squirrels (*Spermophilus variegatus*) in Southeastern Arizona. J. Mammalogy 71:171-176. Rock squirrels exhibit intra- and intersexual overlap of home ranges, with the largest ranges claimed by adult males during breeding season (May/June).



Non-native species: Species that have been accidentally or purposefully introduced into an ecosystem may have impacts that were not anticipated, but have been captured by studies such as:

- Bock, C. E., J.H.Bock, L.Kennedy, Z.F. Jones. 2007. Spread of Non-native Grasses into Grazed Versus Ungrazed Desert Grasslands. *J. of Arid Environments* 71: 229-235. Protection from grazing lessened the speed of invasion by exotic grasses, but did not halt the spread of Lehmann or Boer Lovegrass.
- McLaughlin, Steven P., Janice E. Bowers. 2007. Effects of Exotic Grasses on Soil Seed Banks in Southeastern Arizona Grasslands. *Western North American Naturalist* 67(2):206-218. The seed bank in grasslands dominated by exotic grasses includes very little native seed.
- Jones, Zach. 2003. The Impacts of an Exotic Habitat on the Population Dynamics of a Grassland Specialist, the Botteri's Sparrow (*Aimophila botterii*), in Southeastern Arizona. PhD. Thesis, Department of Environmental, Population, and Organismic Biology. U. of Co. 63 pgs. Results indicate the species of grass is not as important to nesting success as height and cover provided.

Grazing: The Research Ranch has been virtually ungrazed by domestic livestock since 1968, and thus provides a control or reference area to evaluate the impacts of domestic livestock on semi-arid grasslands that did not co-evolve under pressure from large herds of grazing herbivores.

Allington, G.R.H. and T.J. Valone. 2011. Long-Term Livestock Exclusion in an Arid Grassland Alters Vegetation and Soil. *Rangeland Ecol. Mgt.* 64 (in press). Exclusion of cattle resulted in lower bulk density and higher water infiltration. Perennial grass cover was higher within the enclosure. Plains lovegrass and Hairy Grama were more common than on the neighboring cattle ranch.



Debano, Sandra J. 2006. Effects of Livestock Grazing on Aboveground Insect Communities in Semi-arid Grasslands of Southeastern Arizona. *Biodiversity and Conservation* 15:207-222. Invertebrates in grasslands outside of the historic range of bison may be sensitive to grazing by domestic livestock.

Brady, W.W, M.R. Stromberg, E.F. Aldon, C.D. Bonham, S.H. Henry. 1989. Response of a Semidesert Grassland to 16 Years of Rest from Grazing. *J. Range Management* 42:284-288. There was no significant difference in canopy cover between grazed and ungrazed plots, but cover of midgrasses was significantly greater in ungrazed areas.

Fire: Fire is an integral component of grassland ecosystems and is necessary to maintain the health and integrity of grasslands in the southwest. Many studies have examined the effects of wildfire and prescribed fire on the ecosystem and/or species within those ecosystems. Some have reported on the interaction between fire and livestock.

Bock, C.E., Z.F. Jones, L.J. Kennedy, & J.E. Bock. 2011. Response of Rodents to Wildfire and Livestock Grazing in an Arizona Desert Grassland. *Am. Midl. Nat.* 166: 126-138. Most Cricetidae populations declined post fire and took up to 6 years



to recover. Heteromyidae increased after the fire, especially on ungrazed plots.

Bock, Carl E., Linda Kennedy, Jane H. Bock, Zach F. Jones. 2007. Effects of Fire Frequency and Intensity on Velvet Mesquite in an Arizona Grassland. *Rangeland Ecology & Management* 60(5): 508-514. Results suggest that repeated fires could have prevented the historic spread of mesquite into southwestern grasslands and could be used to control mesquite in areas with sufficient fine fuels.

Thomas, P.A., P. Goodson. 1992. Conservation of Succulents in Desert Grasslands Managed by Fire. *Biological Conservation* 60: 91-100. The majority of cacti survived a fire, but fewer plants survived intense or repeated fires.

Exurbanization: Recently many acres of grassland have undergone conversion from open range into small to medium sized household parcels. This land use change has far reaching implications, many of which have been documented by studies using the Research Ranch as undeveloped control.

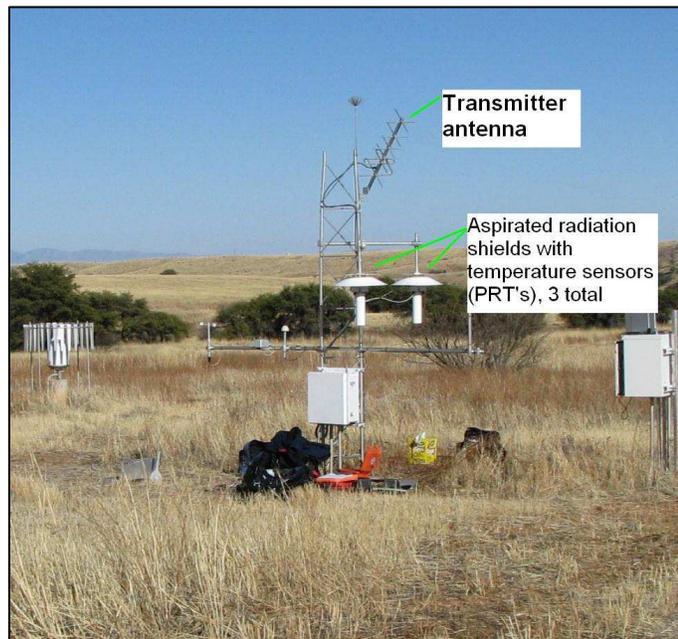
Audsley, Blake W., Carl E. Bock, Zach F. Jones, Jane H. Bock, Hobart M. Smith. 2005. Lizard Abundance in an Exurban Southwestern Savanna, and the Possible Importance of Roadrunner Predation. *American Midland Naturalist*.155:395-401. Roadrunners, especially in developed areas with livestock, appear to suppress terrestrial lizard populations.

Bock, C. E., Z. F. Jones, and J. H. Bock. 2008. The Oasis Effect: Response of Birds to Exurban Development in a Southwestern Savanna. *Ecological Applications* 18:1093-1106. Diversity of birds was studied in grazed and ungrazed areas, low-density exurban areas or both, or neither. In low density ex-urban areas, most birds increased in numbers probably due to food, shade, nest sites, and water that was available at home sites.

Climate: Many studies rely on data provided via the two meteorological stations within the Research Ranch, maintained by the National Oceanographic and Atmospheric Administration and the U.S.D.A. Agricultural Research Service, such as:

Krishnan, P., T.P. Meyers, R.L. Scott, L. Kennedy, and M.Heuer. 2011. Energy exchange and evapotranspiration over two temperate semi-arid grasslands in North America. *Agricultural and Forest Meteorology* (n press). Soil water conditions and vegetation was found to strongly influence energy exchange and evaporation.

Yang, F., K. Ichii, et al. 2007. "Developing a Continental-Scale Measure of Gross Primary Production by Combining MODIS and AmeriFlux Data through Support Vector Machine Approach." *Remote Sensing of Environment*: 14. A predictive gross primary productivity model was developed, in which the most important factor was enhanced vegetation index.



By celebrating the 25th anniversary of the signing of this cooperative agreement, we acknowledged the foresight and courage of those administrators from both BLM and Audubon who dared to think that trust, cooperation and partnership could lead to a productive relationship. It is significant that the Cooperative Agreement has no termination date – and neither does conservation nor research. Let's not disappoint the visionaries behind the Research Ranch and this Cooperative Agreement in the next quarter century!