ANNOTATED BIBLIOGRAPHY
OF SELECTED PUBLICATIONS AND THESES
(BY YEAR)

BY RUTH E. DYSON

February 20, 2008

National Audubon Society Appleton-Whittell Research Ranch (AWRR)
HC 1 Box 44, Elgin, Arizona 85611 520-455-5522

* = Research conducted on or sponsored by AWRR
**= Articles/books about ARR; by or with input from AWRR staff
+ = Research/article conducted on area near AWRR

2007

*Bock, Carl 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.

Indications are that (1) protection from grazing reduced the rate of exotic invasions into native grasslands; (2) areas deliberately planted with the exotics developed into near monocultures even under livestock exclusion; (3) livestock grazing is an exogenous disturbance to which exotics are better adapted than most native grasses.

*Bock, Carl E., Zach F. Jones, Jane H. Bock. 2007. **Relationships between Species Richness, Evenness, and Abundance in a Southwestern Savanna.** Ecology 88(5): 1322-1327.

Species richness, evenness and abundance were compared among flowering plants, grasshoppers, butterflies, lizards, summer/winter birds, and rodents in grasslands and mesquite-oak savannas. Among the relationships found: richness and evenness in each group were uncorrelated showing that richness alone is an incomplete measure of diversity; evenness was positively correlated with abundance variables, reflecting that plots with high evenness generally were those where all species present were about equally uncommon; species diversity was more positively correlated with evenness than with richness among grasshoppers and flowering plants; positive correlation between richness and abundance were comparatively weak for grasshoppers and plants as well.

*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.

Increases of velvet mesquite might have been caused by livestock consumption of fuels that once burned with sufficient fequency and intensity to kill the trees. However, attempts to control mesquite with fire usually have failed. The results suggest that repeated fires likely could have prevented the historic spread of velvet mesquite into southwestern grasslands, but probably could be used to control mesquite today only in areas wehre abundant herbaceous growth provides sufficient fine fuels.

*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.

After the wildfire of 2002, seed banks were sampled during the following four months of 2002 and June of 2003. Of 50 species detected in the soil samples, only 20 had a persistent seed bank, and only 1 of these was a native perennial bunchgrass. The preponderance of transient species means that eradication of exotic grasses must be followed by reseeding of natïve grasses and herbs, perhaps repeatedly, if native grassland is to replace erotic grassland.

Nijhuis, Michael. 2007. **Dead End. Audubon, September-October 2007: 65-70.

As the bitter debate over illegal immigration rages, the first of many planned barriers, a 295-mile-long wall, is being built through a remote desert corridor along the U.S.-Mexico border. This spells trouble for the jaguar, the Sonoran pronghorn, the cactus pygmy owl, and other imperiled animals that are already struggling to survive, by walling off essential habitat.

2006

*Bock, Carl E., Richard A. Bailowitz, Douglas W. Danforth, Zach R. Jones, Jane H. Bock. 2006. **Butterflies and Exurban Development in Southeastern Arizona.** Landscape and Urban Planning, Published by Elsevier B.V. 2006. 11.

A survey of butterflies in grasslands, mesquite savannas, and oak savannas that were grazed by livestock, embedded in low-density developments, or both, or neither showed that livestock grazing had little impact on butterfly species richness or abundance, while exurban development had minor impacts. The results of the study suggest that increased resources associated with housing development, including water, shade, and nectar, and possible negative impacts of increased avian predation and pesticide use, caused relationships between butterflies and native vegetation to be less tightly coupled in exurban than in undeveloped landscapes.

*Bock, Carl E., Zach E. Jones, Jane H. Bock. 2006. **Abundance of Cottontails (*Sylvilagus)* in an Exurbanizing Southwestern Savanna.** The Southwestern Naturalist 51(3):352-357 .

A counting survey was taken of cottontails in a grassland, a mesquite-oak savanna, evenly divided among landscapes that were grazed by livestock, embedded in housing developments, or both or neither. The cottontails were more abundant in exurban neighborhoods than in undeveloped areas, independent of grazing, more commom on ungrazed than on grazed lands, independent of development. Counts were positively correlated with height of ground cover, percent of tree canopy and with the numbers of homes near plots. Results showed that cottontails benefited from exurban development because of increased cover provided by structures and landscaping, especially in areas such as open grasslands with relatively little natural cover.

*Bock, Carl. E., Zach F. Jones, Jane H. Bock. 2006. **Grasshopper Abundnce in an Arizona Rangeland Undergoing Exurban Development.** Rangeland Ecology and Management 59(6):640-647.

Grasshopper species richness was unrelated to grazing or development, but grasshopper abundance was much higher on exurban transects where homeowners kept livestock than in the other areas. Abundance patterns of 3 grasshopper subfamilies were generally consistent with their known habitat preferences. Results suggest that heterogeneous landscapes in exurban areas that included small livestock pastures had higher grasshopper densities than either ungrazed areas or large cattle ranches.

*Bock, Carl E., Zach R. Jones, Jane H. Bock. 2006. **Rodent Communities in an Exurbanizing Southwestern Landscape (U.S.A.).** Society for Conservation Biology, Vol. 20, No.4: 1242-1250.

Independent of habitat or development, rodent species richness, mean rank abundance and capture rates of all rodents combined were negatively related to presence of livestock grazing or to its effects on vegetative ground cover. Exurban development had no obvious effects on rodent variey or abundance. Results suggest southwestern exurban developments can sustain a rich assemblage of grassland and savanna rodents if housing densities are low and houses are embedded in a matrix of natural vegetation with little grazing.

*Debano, Sandra J. 2006. **Effects of Livestock Grazing on Aboveground Insect Communities in Semi-arid Grasslands of Southeastern Arizona.** Biodiversity and Conservation (2006) 15:207-222.

Insect abundance, richness, diversity, community composition, and key environmental variables were compared between sites on active cattle ranches and on land that has not been grazed for over 25 years. Vegetation-associated insect communities were found to be sensitive to grazing; beetles were less rich, flies were less diverse, and Hymenoptera were less rich and diverse. The study suggests that invertebrates in areas outside of the historic range of bison, may be more sensitive to grazing pressure.

*Hass, Christine C., Jerry W. Dregoo. 2006. **Rabies in Hooded and Striped Skunks in Arizona.** J. of Wildlife Diseases, 42(4), 2006: 825-829.

Arizona is home to four species of skunks, and rabies is enzootic in the region where their ranges overlap. Examination of state health data from 1985-2004 revealed an irregular 4-10 yr periodicity in the number of cases annually, which may be related to past precipitation patterns. The number of rabid skunks peaked during springtime. Locations of rabies epizootics changed over time, but there was no evidence of a large-scale geographic spread. Live-trapped skunks had a low prevalence of rabies-virus neutralizing antibodies.

*Marsett, Robert C., Jiaguo Qi, Philip Heilman, Sharon H. Biedenbender, M. Carolyn Watson, Saud Amer, Mark Weltz, David Goodrich, Roseann Marsett. 2006. **Remote Sensing for Grassland Management in the Arid Southwest.** Rangeland Ecology & Management 59(5): 530-540.

Based on the expressed needs of rangeland managers for a way to monitor vegetation on grassland, the RANGES (Rangeland Analysis Utilizing Geospatial Information Science) was defined to be the accurate conversion of remotely sensed data for quantitative estimates of total (green and senescent) standing cover and biomass on grasslands and semideset grasslands. Comparison of the remotely sensed estimates with independent ground measurements produced values of .80, .85, .77. The approach for estimating plant height and biomass did not work for sites where forbs comprised more than 30% of total vegetative cover. The ground reconnaissance protocol and image processing techniques together offer land managers accurate and timely methods for monitoring extensive grasslands.

*McLaughlin, Steven P., Janice E. Bowers. 2006. **Plant Species Richness at Different Scales in Native and Exotic Grasslands in Southeastern Arizona.** Western North American Naturalist 66(2):209-221.

Species richness in Madrean mixed-grass prairies dominated by native or exotic species in southeastern Arizona was analyzed and studied. Some of the results were: richness was higher in oak savanna (OS) than in exotic grassland on mesa tops (EMT), whereas native grassland on mesa slopes (NMT) and native grassland on mesa tops (NMT) did not differ in richness from OS or EMT. Madrean mixed-grass prairies are landscapes with high species richness in comparison to other grassland types in North America, providing a large pool of potential colonizing species at the community scale.

*Supplee, Tice. 2006. **Identifying Arizona's Important Bird Areas.** Arizona Wildlife Views. November-December 2006:29-31.

Designation of Important Bird Areas (IBA) is an ongoing national effort by the national Audubon Society in partnership with the Arizona Game and Fish Department. Since habitat loss and fragmentation are serious threats to bird populations across the U.S. and around the world, identifying places to breed, stop to rest and feed on migration, or call "home" in the winter is the first step to conserve these areas. 26 IBA's have been idendified in Arizona, and 6 more are proposed. The Audubon Appleton-Whittell Research Ranch is one these areas.

*Thomas, P.A. 2006. **Mortality Over 16 Years of Cacti in a Burnt Desert Grassland.** Plant Ecology (2006) 183: 9-17.

Mortality of small cacti after grassland fires is usually less than 25% within 2 years. 100% of the 50 marked plants of each of four species of small cacti on burnt and unburnt desert-grassland in Arizona were dead within 16 years. Fire more rapidly removed the breeding populations reducing seed availabilty, increasing the risk of local extinction. Cacti did establish on the study areas and by the end were of a similar size to the dead cohort giving the superficial impression that the site was unchanged.

*Titus, Priscilla. 2006. **Umbeling Onward.** Clintonia, vol. 21, Issue 2, 2006:10-11.

The Huachuca water umbel (*Lilaeopsis schaffneriana ssp. Recurva)* is an endangered species that only occurs in southeast Arizona. A perennial, diminutive and hard to detect plant, it is found in the wetland features scattered across the region. It is consistent with the ecology of this plant that small weakly-rooted clumps tear off as a result of the scouring during flood events and float downstream to take root elsewhere. Declines in the Huachuca water umbel population viability can signal declines in the other flora and fauna that share the same habitat.

*Wheeler, Jr., A.G. 2006. ***Prairiana Orizaba* Ball and Reeves (Hemiptera: Cicadomorpha: Cicadellidae), Colonist of the Introduced African Bunchgrass *Eragrostis curvula* (Poaceae), with Notes on the Use of Little Bluestem, *Schizachyrium Scoparium* (Poaceae) by *P.Kansana* (Ball).** Proceedings of the Entomological Society of Washington, 108(4):868-877.

The leafhopper (*Prairiana orizaba)* has been in five of the southern states, including Arizona and Texas. Host plants were almost exlusively weeping lovegrass. Native grasses on which nymphs were collected were at one site only in AZ, and included *Aristida purpurea, Bothriochloa barbinodis* and *Bouteloua curtipendula.* Weeping lovegrass is also a host plant there. *Prairiana kansana* developed on little bluestem in S. Carolina, Nebraska and Texas.

2005

*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.

The number of lizards in a grassland and mesquite/oak savanna, grazed land, and embedded in housing developments were compared. Terrestrial lizards as a group were scarce in developed areas, especially where homeowners kept livestock. Roadrunners, known predators of terrestrial lizards, were more common in developed areas, especially those that were grazed. Predation by other species, especially domestic pets, may also have been important.

*Bishop, Kristin Whitney. 2005. **Mortality, Reproduction, and Re-sprout of Oaks Following a Wildfire in Southeastern Arizona.** M.A. Thesis, Department of Ecology and Evolutionary Biology. U. of Co. 43 pgs.

Following the wildfire in 2003 covering grazed and ungrazed Madrean oak savanna, *Q. emoryi* was more susceptible to crown mortality, but the *Q. emoryi's* greater sprouting response compensates for this higher susceptibility. Percent crown survival in both species was independent of tree height, trunk diameter, and topography. Acorn production estimates suggest that the reduction of fine fuels by grazing resulted in higher acorn production for surviving parts of burned trees for both species. *Q. emoryi* seedling densities were higher than *Q. arizonica.* The two species differ in their survival and reponse to wildfire; wildfire and grazing are interactive in their effects on oak mortality and recruitment in Madrean evergreen savannas.

*Bock, Carl E., Jane H. Bock, Stephen Strom, Photographer. 2005. ***Sonoita Plain: Views from a Southwestern Grassland.*** University of Arizona Press, Tucson. 121 pgs.

Through essays and photographs focusing on the Appleton-Whittell Research Ranch and surrounding area, the book reveals the complex ecology and unique aesthetics of its grasslands and savannas, as well as its environment, biodiversity and human history. It first considers the ecosystems of the Sonoita Valley, then presents a selection of stories about the diverse life forms here, and lastly considers the humans who have come to the valley, over-time and to the present.

John A.Hall, Stephanie Weinstein, Cheryl L. McIntyre. 2005. **The Impacts of Livestock Grazing in the Sonoran Desert: A Literature Review and Synthesis. The Nature Conservancy, Phoenix Field Office. Federal Cooperative Agreement No. AAA-02-0005, Task Order AAF-02-0001. 298 pgs.

At the request of the BLM, The Nature Conservancy reviewed the literature regarding: (1) the impact of cattle on natural and cultural resources in desert ecosystems, (2) the implications of different grazing management strategies, (3) Sonoran Desert plant community dynamics. The literature does document that livestock grazing can cause adverse impacts, but does not provide sufficient information regarding thresholds of grazing intensity and effect on the ecosystem. Compared to more productive rangelands, both domestic livestock grazing impacts and grazing management stategies are poorly documented for the Sonoran Desert. No currently described approach, including continuous grazing and each of the specialized grazing systems, seems completely applicable to the Sonoran Desert. The study of literature also includes looking at the effects of grazing on plant communities, Saguaro recruitment and survival, other plant species, soils and biological soil crusts, wildlife, and cultural sites.

*Jones, Zach F., Carl E. Bock. 2005. **The Botteri's Sparrow and Exotic Arizona Grasslands: An Ecological Trap or Habitat Regained?** Condor 107: 731-741.

The Botteri's Sparrow, a bird of tall grasslands, disappeared during the heavy grazing of the 1890's. It first returned in sacaton, an uncommon native floodplain tallgrass and then in stands of exotic lovegrasses. The study found that abundance and site fidelity were positively associated with grass height and cover, being greatest in sacaton, intermediate in exotics, and lowest in native upland grasslands. Far from being an ecological trap, the exotic lovegrasses apparently are providing essential cover for the Botteri's Sparrow in Arizona.

*Kupfer, John A., Jay D. Miller. 2005. **Wildfire Effects and Post-fire Responses of an Invasive Mesquite Population: The Interactive Importance of Grazing and Non-native Herbaceous Species Invasion.** J. of Biogeography (2005) 32:453-466.

Nearly all the mesquite trees on grazed areas suffered low levels of fire damage, had more leaf-bearing twigs and branches and a low number of root sprouts. A majority on ungrazed areas suffered moderate to severe damage, had more root sprouts but little post-fire dead branching and almost no living branches. Among the ungrazed grassland, more than 75% on Boer lovegrass plots suffered moderate to severe damage, while 75% of those in native grass areas suffered low damage. As managers shift their focus from eradication to management of mesquite, they need to look at the differences between wildfires and prescribed burns (and their effects on mesquite population) and how such effects may be mediated by altered land uses and ecosystem characteristics.

*Ortiz-Barney, Elena. 2005. **Seed Banks in Desert Grasslands and Implications for Management with an Application to Education and Outreach.** PhD. Dissertation. Arizona State University. 108 pgs.

Because large areas of desert grasslands have been converted to shrublands, land managers are interested in the potential for restoring these areas. A source of new individuals of desirable grasses is the soil seed bank. Soil samples were collected at different sites with different vegetative cover and at different depths including pre-and-post burns. Most seed, as well as highest species richness, occurred in the litter layer and under shrubs. Prescribed burns reached average temperatures of above 100 degrees C.; none of the species tolerated this. Depleting the soil seed banks is a risk associated with prescribed burns that could affect restoration efforts. A lesson plan on teaching plant community succession concepts and its evaluation of its effectiveness with students is included.

*Pearcy II, Charles M. 2005. **The Impact of Background Resolution on Target Acquisitions Weapons Software (TAWS) Sensor Performance.** M.S. in Meteorology Thesis. Naval Postgraduate School, Monterey, CA. 67 pgs.

This study evaluated the sensitivity of the TAWS (Target Acquisitions Weapons Software) detection range calculations to the spatial resolution of scenario backgrounds. 16 independent sites (including the Appleton-Whittell Research Ranch) were analyzed to determine TAWS background. It was refined to include soil moisture characteristics. The use of the current default TAWS background database was shown to result in TAWS ranges differing from the 1m standard range by 18-23%. The uncertainty was reduced to 5% when background resolution was improved to 8km in rural areas. These results suggest that the rural and urban designations are important to the definition of a background database.

*Wheeler, Jr., A.G. 2005. ***Blissus minutus* (Blatchley) and *Toonglasa Umbrata* (Distant): Seldom-collected Native Chinch Bugs (Hemiptera: Lygaeoidea: Blissidae) as Colonists of the African Bunchgrass *Eragrostis Curvula,* and their Association with Other Grasses in the Southern United States.** Proceedings of the Entomological Society of Washington, Vol 107(2), 2005, 336-345.

Weeping lovegrass, an African bunchgrass first introduced into the U.S. in the late 1920's, has acquired a diverse insect fauna in the southern states, among them are the chinch bugs. *Toonglasa umbrata* was collected in Arizona, New Mexico, and Texas from seven native grasses and one introduced grass, in addition to weeping lovegrass, and was the only blissid found on weeping lovegrass in the more arid regions of those states.

2004

Bristow, Kirby D., Richard A.Ockenfels. 2004. **Pairing Season Habitat Selection by Montezuma Quail in Southeastern Arizona. J. of Range Management 57:532-538 pgs.

Habitat selection of the Montezuma quail was studied in grazed and ungrazed areas of the Huachuca and Santa Rita mountain foothills. The quail selected areas with higher grass canopy cover and more trees than randomly available. In order to provide optimum cover availability, oak woodland habitats should contain a minimum 26% tree canopy and 51-75% grass canopy cover at the 20cm height.

*Burtt Jr., Edward H., Jann M. Ichida. 2004. **Gloger's Rule, Feather-Degrading Bacteria, and Color Variation among Song Sparrows.** Condor 106:681-686.

Gloger's rule states that feathers tend to be darkly colored in habitats where relative humidity is high and pale where it is low. This may result from selection for dark feathers that are more resistant than light feathers to bacterial degradation, which is a severe problem in humid habitats. Under lab conditions, feather-degrading bacteria from the plumage of sparrows in the humid Northwest degraded feathers more rapidly annd more completely than feather-degrading bacteria from sparrows of the arid Southwest. This produced a difference in the intensity of selection, which in turn produces the difference in color described in Gloger's rule.

*Lombardo, Keith. 2004. **Alteration of Biodiversity and Ecosystem Processes by *eragrostis lehmanniana* Nees and *eragrostis curvula* (Schrad.) Nees var. *conferta* Stapf. following a Wildfire in Southeastern Arizona.** M.A. Thesis. Department of Geography and Regional Development, U. of AZ. 42 pgs.

A pre-and post-fire comparison between non-native and native dominated grasslands shows differences appearing after the fire in aboveground biomass, soil structure, species composition and diversity. The spread of non-native grasses at the expense of native grasses appears to be leading towards significant transformations in native ecosystem characteristics including fire intensity and species composition.

*Russell, Gary. 2004. **Onionweed (*Asphodelus fistulosus*): 2004 Survey and Eradication Report.** Report issued by United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Plant Protections and Quarantine (PPQ). 11 pgs.

Onionweed was found in 39 locations throughout AZ in five differents towns (Tombstone, Sierra Vista, Bisbee, Sonoita, Sedona). A survey of Fort Huachuca, Ajo, I-19 from the Mexican border to Tucson reported no sightings of the plant there. The eradication effort was done by hand pulling by paid employees, federal and state government agencies, city officials, gardening groups, museum curators and the general public. Timeliness is critical when conducting surveys and eradication efforts because the plant is easily identified during the flowering stage while it is almost invisible after it goes to seed.

*Swann, Don E., Christine C. Hass, David C. Dalton, Sandy A. Wolf. 2004. **Infrared-triggered Cameras for Detecting Wildlife: An Evaluation and Review.** Wildlife Society Bulletin 32(2): 357-365 pgs.

The abilities of 6 infrared-triggered camera systems were evaluated. All systems tested had a detection zone that was narrow in the vertical dimension and all but one had a detection zone that was narrow in the horizontal dimension. The authors also reviewed technical aspects of infrared-triggered photography and recommended how researchers can improve their success in detecting animals by selecting the appropriate system and by careful placement and precise alignment of camera units in the field.

*Tiller, Ronald L. 2004. **Seed Ecology, Productivity and Water Source Use by *Sporobolus wrightii*.** PhD. Dissertation. Arizona State University. 126 pgs.

Sporobolus wrightii grows in habitats that span groundwater depths of less than 3m along unincised floodplains to more than 8m on terraces. It uses groundwater and/or stored moisture when moisture is scarce in the upper soil profile but uses shallow soil moisture during the summer monsoon. *Sporobolus wrightii* terrace grasslands have a seed bank and high plant density and is fast germinating under optimum summer conditions. Seeding or transplanting seed-rich soil from grasslands may be required to re-establish sacacton in abandoned fields.

Restoration should focus on areas where summer precipitation is greatest and where sites maintain shallow (greater than 3 to 4 m) depth to groundwater.

2003

*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 Envionmental, Population, and Organismic Biology. U. of Co. 63 pgs.

The Botteri's Sparrow is a tallgrass specialist, once believed to be restricted to Sacaton grasslands. This study suggests that the type of grass is not as important as the height and cover it provides. By the latter part of the 1900's, the relatively lush exotic lovegrasses had become regionally widespread in the Southwest, and because these lovegrasses apparently are suitable nesting habitat, the Botteri's Sparrow may now sustain a range and abundance that rivals, or even exceeds, its pre-grazing occurrence.

*Jones, Zach E., Carl E. Bock, Jane H. Bock. 2003. **Rodent Communities in a Grazed and Ungrazed Arizona Grassland, and a Model of Habitat Relationships Among Rodents in Southwestern Grass/Shrubland.** The American Midland Naturalist 149:384-394.

Based on the results of this and other field studies, a model was developed for the composition of rodent communities in grass/shrublands of the Southwest and Intermountain West, based on ground cover. Kangaroo rats are abundant in areas with the most bare soil, Muridae dominate areas with the most and tallest ground cover, and pocket mice are common in areas of intermediate cover. The model suggests that a landscape mosaic of grass and shrublands with varying amounts of ground cover, including some relatively dense grassland, likely will maintain the highest regional diversity of rodents.

*Kloor, Keith. 2003. **Fire in the Sky.** Audubon Magazine 105(3): 75-79pgs.

In April of 2003, the Ryan fire swept through the Appleton-Whittell Research Ranch burning over 90% of the 8000-acre grassland sanctuary in less than an hour. The article describes the fire, its aftermath, the previous history of the ranch land and how after the summer monsoons, the ranch began to grow again, proving that fires can also be beneficial in the long run.

*Kupfer, John. 2003. **Restoration of Semi-desert Grassland Invaded by Exotic Lovegrasses**. Progress report to International Arid Lands Consortium. 12pgs.

Proposal uses a combined field and modeling approach to determine the effects of restoration efforts in semi-desert grasslands dominated by non-native lovegrasses. Productivity and chemical constitution of both native and introduced species as well as interactions between the plant community and the soil will be examined by coupling results of the field study with a biogeochemical process model, Century.

*Lombardo, K., J.A. Kupfer. 2003. **The Interactive Effects of Fire and Invasive Species on an Arizona Semi-desert Grassland.** Abstract submitted to Annual Meeting of the Association of American Geographers, New Orleans, March 2003.

Comparisons between pre-fire and post-fire showed significant differences in total aboveground biomass, litter quantity, species composition, species richness and soil characteristics (especially magnesuim, potassium and phosphorous) between native-dominated grasslands and non-native dominated grasslands. Post-fire soil samples also suggest that the non-native species may potentially alter fire effects due to their greater amount of biomass which altered fire intensity.

*Ortiz-Barney, E., J.C. Stromberg. 2003. **Heat Tolerance of Grass Seeds in Desert Grasslands and their Vulnerability to Prescribed Burning.** Ecological Society of American's 88th Annual Meeting, Savannah, GA. Aug. 3-8, 2003. (poster)

Poster showed measurements of maximum fire temperature during prescribed burns at two field sites and two soil depths. Results indicate that prescribed burning may damage viable seed reserves on the surface of the soil.

*Paige, Ginger B., Jeffry J. Stone, D. Phillip Guertin, Rachel McGee, Hana Blumenfeld. 2003. **Runoff and Erosion in Semi-arid Grassland after a Wildfire.** Second International Wildlife Fire Ecology and Fire Management Congress and Fifty Syposium on Fire and Forest Meteorology. Nov. 16-20, 2003.

Rainfall simulator experiments were conducted following a wildfire and 1 year later to measure and quantify runoff and erosion processes on a semi-arid grassland. Results will be used to develop parameters that can be used to evalutae runoff and erosion risks following wildfires.

*Robinett, Daniel, Linda Kennedy. 2003. **Ryan Fire and Drought Effects on Grazed and Un-grazed Grasslands in southern Arizona.** Poster.

Poster showed that the combined effects of drought and fire resulted in significant declines of basal cover of perennial grasses during the first years after on both grazed and un-grazed areas.

*Titus, Jon. 2003. **Fires in Arizona's Grasslands.** Arizona Native Plant Society, The Plant Press 27(2): 1,5,6 pgs.

Because of the extended drought in the 1890's, the vegetation of AZ is very different than it was 125 years ago. The earlier influx of cattle -- and then no water -- created a barren land with topsoil washed away and no grasses or shrubs to hold it in place. Nowadays, overgrazing can result in compacted soil (which decreases water infiltration and increases runoff and erosion), an increase in shrub dominace over grasslands. The fire season also occurs earlier when the grasses are dry and susceptible to human sparks which may result in differences in the vegetation and wildlife populations. Addressing the problems associated with wildfires will be complex, expensive, and slow.

USDI, BLM. 2003. **Approved Las Cienegas Resource Management Plan and Record of Decision. BLM/AZ/PL-03/010. 83pgs

The Las Cienegas Resource Managemnt Plan (RMP), a plan for managing 49,000 acres of public land, resources and uses within the Las Cienegas National Conservation Area and the Sonoita Valley Acquisition Planning District, was developed with broad public participation through a six-year collaborative planning process. As well as outlining land use plan decisions, the RMP includes a series of management actions to meet the desired resource conditions for upland and riparian vegetation, wildlife habitats, cultural and visual resources, as well as livestock grazing and recreation management actions.

2002

*Biedenbender, Sharon H., Robert C. Marsett, Phil Heilman, Jaiguo Qi. 2002. **Effective Delivery of Geospatial Information to Range Managers.** Abstract: Ecological Society of America 87th Annual Meeting/Society for Ecological Restoration 14th Annual International Conference. August 4-9, Tucson AZ. Pg. 320.

End-user input on the usefulness of remotely sensed information types, delivery formats and delivery means has been incorporated into the RANGES (Rangeland Analysis Utilizing Geospatial Science) project.

*Blumenfeld, Hana Devorah. 2002. **Quantifying Rangeland Health Indicators Using Runoff and Sediment From Rainfall Simulator Experiments.** M.S. Thesis with a Major in Watershed Management. School of Renewable Natural Resources, U of AZ, Tucson. 165 pgs.

Using the rangeland health indicators of point intercept and gap intercept, quantitative methods of study indicate that runoff and sediment yield have a positive relationship with gap length and a negative relationship with amount of cover. Two burned ecological sites helped assiss the indicators' ability to relate runoff and erosion for different site conditions.

*Bock, Jane H., Carl E. Bock. 2002. **Wildflowers, Weeds, Precipitation, and Livestock Grazing in an Arizona Grassland.** Abstract: Ecological Society of America 87th Annual Meeting/Society for Ecological Restoration 14th Annual International Conference. August 4-9, Tucson, AZ. Pg.79.

In summer of 2001 when winter precipitation had exceeded 25 cm., wildflower cover equaled that of native grasses and was significantly lower on livestock-grazed areas than on ungrazed

native grassland, and much lower still in plantations of exotic African lovegrasses. Results suggest the important positive influence of winter rain on many of the wildflower species, and the negative effects of grazing and exotics.

*Bock, Jane H., Katy Human. 2002. **NGOs and the Protection of Biodiversity: The Ecologists' Views.** Colorado Journal of International Environmental Law and Policy. Vol. 13(1): 167-181.

The paper explores the problem of biodiversity loss -- how NGOs are working to define the magnitude of the problem and influence citizens and government agencies to consider biodiversity impacts in their decision-making. It also summarized the panel discussion on biodiversity held at the symposium. *A Cartography of Governance: Exploring the Province of Environmental NGOs* held at the University of Colorado School of Law, spring 2002.

Hass, Christine C. 2002. **Home-range Dynamics of White-nosed Coatis in Southeastern Arizona. J. of Mammalogy 83(4): 934-946.

Sizes of home ranges and core areas did not change during the study, even though density of coatis declined. Locations of annual home ranges and core areas shifted slightly from year to year, indicating minor range drift but no nomadism. Mortality due to predation was significantly higher in the periphery of the home range than that predicted based on the probability of occurrence.

*Heilman, Philip, Robin Marsett, Jaiguo Qi, Sharon Biedenbender. 2002. **New Remote Sensing Products for Grassland Management.** P. 62 in (W. L. Halvorson and B. S. Gebow, editors) *Meeting Resource Management Information Needs: Fourth Conference on Research and Resource Management in the Southwestern Deserts, Extended Abstracts.* USGS Sonoran Desert Field Station, U. of AZ, Tucson.

New technology now makes it possible to use remote sensing to estimate canopy cover, vegetation height, and standing biomass on grasslands in Arizona and New Mexico. This information is spatially distributed and can be manipulated using geographic information systems, or used to derive other layers of data of interest. This should be of help to public and private land managers who are responsible for managing very large areas.

*Jones, Zach F., Carl E. Bock. 2002. **Nest Success as a Misleading Indicator of Habitat Quality in the Botteri's Sparrow.** Abstract: Ecological Society of America 87th Annual Meeting/Society for Ecological Restoration 14th Annual Internationa Conference. August 4-9, Tucson, AZ. Pg. 171.

Although nest predation was higher and young fledged/territory was lower in sacaton grasslands, individual Botteri sparroiws preferred to nest there. Vegetation measurements revealed that fledglings occurred in places with taller grass and less bare ground indicating that concealment of young is a key componenet of habitat quality resulting in higher rates of juvenile survival.

*Kennedy, Linda J., R.L.Tiller, J.C. Stutz. 2002. **Associations between Arbuscular Mycorrhizal Fungi and *Sporobolus wrightii* in Riparian Habitats in Arid South-western North America.** Journal of Arid Environments 50: 459-475.

Seasonal dynamics of arbuscular mycorrhizal (AM) colonization of *Sporobolus wrightii* and AM fungal communities were assessed in sites which represented upper terrace or lower floodplain habitats, and perennial or intermittent river reaches. Colonization was coordinated with growth/reproductive stages of plants with higher levels from February to May when plants were primarily vegetative and lower levels in September and December during seed set and onst of domancy. Species richness ranged from 9 to 13 AM fungal species per site.

*Marsett, Robert C., Jaiguo Qi, Sharon H. Biedenbender, Phil Heilman, Osman Wallace, Cuizhen Wang. 2002. **Geospatial Range Management Tools.** Abstract: Ecological Society of America 87th Annual Meeting/Society for Ecological Restoration 14th Annual International Conference. August 4-9, Tucson, AZ. Pg. 171.

The RANGES (Rangeland Analysis Utilizing Geospatial Science) project developed management tools using remote sensing in conjunction with extensive ground reconnaissance.

The high level of accuracy and objectivity of this information should provide unbiased decision support for land management.

*Marquardt, Emily S., Linda J. Kennedy, Lubica Cerminova-Bauml, Jean C. Stutz. 2002. **Arbuscular Mycorrhizal Colonization and Propagule Numbers Associated with Lehmann Lovegrass and Native Semi-arid Grasses.** Abstract: Ecological Society of America 87th Annual Meeting/Society for Ecological Restoration 14th Annual International Conference. August 4-9, Tucson, AZ. Pg. 388.

No significant differences appeared in the level of AM fungal colonization of roots collected from native grass, Lehmann govegrass and transition patch types. Propagule numbers were greatest in soil samples from Plains lovegrass and lowest in samples from blue and side-oats grama.

*Miller, Jay D., Stephen R. Yool. 2002. **Modeling Fire in Semi-desert Grassland/oak Woodland: The Spatial Implications.** Ecological Modeling 153: 229-245.

Estimating fire behavior through the use of computer simulations is one tool to assist in planning management-ignited fire. A comparison was made between the FARSITE and the Northern Forest Fire Laboratory (NFFL) models for producing accurate fire simulations. Simulated fires generated using site specific fuel models were compared to fires simulated using standard generic NFFL fuel types. In the worst case scenario (low fuel moistures and high wind speeds) the average fire size was about 20% larger with the fuel map using NFFL fuel models than with the fine scale map using site specific fuel models.

*Qi, Jiaguo, Osman Wallace. 2002(b). **Biophysical Attributes Estimation from Satellite Images in Arid Regions.** Paper delivered at 2002 International Geoscience and Remote Sensing Symposium, 2002: IV:2000- 2002pgs.

New techniques using shortwave infrared spectral bands of images from the Landsat satellite results in sensitive indices to both green and senescent vegetation and are validated with limited field observations. These can be used operationally to aid rangeland management practices.

*Qi, Jiago, Robin Marsett, Philip Heilman, Sharon Biedenbender, Susan Moran, David Goodrich. 2002. **RANGES Improves Satellite-based Information and Land Cover Assessments in Southwest United States.** Transactions, American Geophysical Union, Vol. 83 (51) 601, 605-606.

Ten field reconnaissance site reports were compared with LANDSAT images across a range of grassland conditions in southwest US to validate fractional cover, canopy height, and herbaceous biomass estimates. Since the correlation coefficients were very high, the authors are confident that these critical vegetation variables can be derived from satellite images to improve site-specific management of rangelands.

+Spakes, Richter Brantlee, Jean D. Stutz. 2002. **Mycorrhizal Inoculation of Big Sacaton: Implications for Grassland Restoration of Abandoned Agricultural Fields.** Restoration Ecology, 10 (34): 607-616.

In order to determine the effects of mycorrhizal inoculation on *S. wrightii* during transplant production and in a restoration trial, plants were grown with and without AM fungi under greenhouse conditions for 8 weeks and then transplanted into an abandoned agricultural field. Plants were monitored for growth, survival and mycorrhizal infection. In the field, pre-inoculated plants had greater survival, basal diameter, and tiller and panicle production through the first two growing seasons. Results indicate that inoculation can benefit restoration efforts in abandoned agriculture fields in semiarid regions.

*Ruth, Janet M., Caleb E. Gordon. 2002. **Response of Wintering Grassland Birds to Vegetation Structure and Composition.** Abstract/Presentation to North American Ornithological Conference, New Orleans. 9/28/2002.

Data indicated that Baird Sparrow abundance was negatively associated with shrub density, positively associated with greater grass structure in the 1-2 decimeter height category, and negatively associated with greater grass structure above 4 decimeters. Data for Grasshopper

Sparrows indicated that abundance was negatively associated with shrub density, and positively associeated with greater grass structure in the 2-3 decimeter height category.

*Smith, Hobart M., David Chiszar. 2002. **The Herpetofauna of the Research Ranch.** University of Colorado Museum and Departmanets of Biology and Psychology. Updated 10/23/2002.

The up-dated list of the herpetofauna of the Appleton-Whittell Research Ranch includes 44 species known or thought to occur on the ranch and incorporates changes in taxonomy and nomenclature that have accrued since the last list was prepared. It includes 6 species of tailless amphibans, 19 of lizards, 17 of snakes, 2 of turtles and 2 introduced species (bullfrog, and Bolson tortoise).

+Spakes, Brantlee Richter, Ronald L. Tiller, Jean C. Stutz. 2002. **Assessment of Arbuscular Mycorrhiazal Fungal Propagules and Colonization from Abandoned Agricultural Fields and Seni-arid Grasslands in Riparian Floodplains.** Applied Soil Ecology 20: 227-238.

Results indicate that higher inoculum potentials in abandoned fields were not always linked to the high levels of recovery of native vegetation.

*Widmer, Kristen A. 2002. **The Relationship between Agave Palmeri Flower Stalk Herbivory and Livestock Management in Southern Arizona.** M.S. Thesis with a Major in Range Management. School of Renewable Natural Resourses. U. of A. Tucson. 86 pgs.

Nectar and pollen of the *A. palmeri* are critical food resources for the endangered lesser long-nosed bat. Cattle can preclude flower development by grazing the emerging flower stalk. Overall, the intensity of flower stalk herbivory was a function of interactions between timing of livestock use and year, and timing of livestock use and distance to water. In areas with cattle present during flower stalk emergence only, the intensity of flower stalk herbivory was related to an interaction between distance to water and stocking rate.

*Woods, Christopher P. 2002. **Ecological Aspects of Torpor Use and Inactivity during Winter by Common Poorwills.** PhD dissertation in Biology. University of Regina, Saskatchewan. 194 pgs.

Common Poorwills are nocturnal insectivorous birds, unique because they are able to enter torpor for prolonged periods. Although lunar illumination strongly influenced poorwill behavior (i.e.activity, vocal, and breeding), it did not correlate with torpor use or inactivity. Ambient temperature was a highly significant predictor of both torpor use and density of flying insects available to poorwills at night The findings also show that inactivity was seasonal in nature and that some poorwills can remain entirely inactive for long periods in winter and that during those times they exhibit physiological patterns typical of mammalian hibernation.

+Wuerthner, George, Mollie Matteson. 2002. ***Welfare Ranching: The Subsidized Destruction of the American West.*** Foundation Ecology, Sausalito, CA. 343 pgs.

With photographs and essays, this book shows not only cases of overgrazing on both private and public lands but also the subtle changes that signal ecological disruption on a massive scale. It explains the cultural and historical causes of the wasting of the West and offers a vision of the renewal possible if citizens ask that their government shift land management priorities to serving the public and natural good, rather than facilitating private gain. It points the way to the greatest opportunity yet remaining, that of ending public lands livestock grazing, for ecological restoration and wildlife protection in this country.

2001

Batabyal, Amitrjeet A. 2001. **Book Review of The View From Bald Hill: Thirty Years in an Arizona Grassland. Journal of Range Management 54(6): 725

After an analysis especially of chapters 2,4,8,11,13, the critic recommends reading it to learn more about the nexuses between extended field research, the intertemporal behavior of grasslands, and conservation policy.

*Breckenfeld, J. Donald, Daniel Robinett. 2001. **Soil and Range Resource Inventory of the National Audubon Society Appleton-Whittell Research Ranch.** USDA Natural Resources Conservation Service. 60 pgs.

The inventory looks at the soil in various settings (i.e.fan terraces, floodplains, alluvail fans, inset fans, dissected relict lake beds, hills), its composition, typical profile, properties and qualities, inclusions, use and management, and special management concerns. It also looks at the soil series and their morphology. 12 different ecological sites on the Appleton-Whittell Research Ranch were identified, described, assessed, and mapped. Also included is a plant list of the ecological sites.

*Chace, Jameson F. 2001. **Host and Habitat Partitioning by Sympatric Brood Parasites in Arizona.** Ph.D. Dissertation, Department of Environmental, Population and Organismic Biology. U.of Co. 162 pgs.

The sympatric brood parasites, Bronzed and Brown-headed Cowbirds, selected host nests nonrandomly, and partitioned hosts by host body size. Brown-Headed cowbirds did not parasitize the large tanagers; the Bronzed Cowbirds did not parasitize the small Painted Redstart and Bell's Vireo. Also, two hyptheses using habitat partitioning and interspecific avoidance for selection of host species were rejected, giving support to host-resource partitioning through host selection. Under higher host diversity and lower cowbird abundance (such as in Arizona), resources are partitioned by body size.

*Geiger, E.L., L. Kennedy. 2001. **Lehmann Lovegrass: A Threat to Southwestern Grasslands.** Abstract submitted to Southwestern Association of Naturalists Meeting, April 20, 21, 2001. Hays, KS

In southwestern Arizona, the spread of non-native grasses is blamed for reductions in biodiversity of multiple species guilds, for altering natural fire regimes, and for associated economic costs. The success of control methods on Lehmann lovegrass including fire, chemical application, mowing, and mulching are anecdotal or inconclusive.

*Jones, Z.F. 2001. **The Botteri Sparrow: An Avian Habitat Specialist Colonizing an Alien Grassland in Southeastern Arizona.** Abstract submitted to Ecological Society of America Meeting 2001.

Boer lovegrass, widely distributed in southern Arizona, may provide novel ecological and evolutionary opportunities for a species that otherwise has been and would continue to be narrowly distributed and uncommon.

*Jones, Z.F. 2001. **Mexican Jays and Northern Flickers: A Mixed-Species Flock in the Oak Savanna of Southern Arizona.** Abstract submitted to Cooper Society Meeting 2001.

In wintertime, flickers followed jays on 45 of 48 occasions they were together. Flickers were significantly more likely to forage when they accompanied jays than when alone, suggesting more time may be devoted to foraging as opposed to predator detecting while in a mixed-species flock.

*McClaren, Mitchel P. and Kristen A. Widmer. 2001. **Inflorivory of Palmer Agave in Relation to Livestock Management.** P. 11 in 2001 Malpai Borderlands Science Meeting, January 8-10, 2001: Gadsden Hotel, Douglas, AZ. 11 pgs.

The nector and pollen of the Palmer Agave are critical food resources for the endangered lesser long-nosed bat. Inflorivory by cattle and wildlife negates flower development. The on-going study aims at evaluating the effects of livestock management practices on the intensity of inflorivory with implications for future livestock management on the Coronado National Forest.

McLaughlin, Steven P., Erika L. Geiger and Janice E. Bowers. 2001. **Flora of the Appleton-Whittell Research Ranch, Northeastern Santa Cruz County, Arizona.** Journal of the Arizona-Nevada Academy of Science 33(2):113-131.

The known vascular flora of the Appleton-Whittell Research Ranch comprises 81 families, 290 genera, 473 native species, and 38 exotic species. One species, *Lygodesmia ramosissima,* is new to the flora of Arizona. Floristic affinities are strongest towards the southeast into Chihuahua and Coahuila.

*Rosen, Philip C. and Cecil R. Schwalbe. 2001. **Leopard Frog Recovery and Restoration Problems in the Malpai Borderlands Region.** P. 8 in 2001 Malpai Borderlands Science Meeting, January 8-10, 2001: Gadsden Hotel, Douglas, AZ. 11 pgs.

Studies of the leopard frog identified: 1) non-native species were primary cause of leopard frog decline; 2) chytrid fungal disease is a current threat; and 3) habitat type (stock ponds or natural water regimes that include flow, drying, re-wetting) is very important in leopard frog persistence. A conservation plan for Chiricahua leopard frog recovery is under formal review within the Department of Interior at this time, and if approved, restoration may resume.

2000

*Appleton, Ariel B., Hobart M. Smith and Jane H. Bock. 2000. **The Bolson Tortoise Project.** P. 6 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing project will organize Appleton's extensive field notes, library searches and correspondence on Bolson Tortoises resulting in a monograph based on her data collection begun in the early 1970's.

*Beck, Holly H. and Anne F. Cross. 2000. **The Effects of Livestock Grazing on Ground Beetle (Coleoptera: Carabidae) Species Composition in a Semi-arid Grassland in Southeast Arizona.** P. 23 *in* (Linda Kennedy and Stephanie Seltzer, editors). *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary analyzed plant species cover, soil moisture and collected ground beetles to evaluate the impact that grazing exerted on the ground beetle community. Ground beetles are particularly sensitive to subtle changes in many types of environmental variables. Large bodied ground beetles were better predictors of the effects of livestock grazing than smaller bodied species. Species richness was generally higher on sites with greater vegetation cover.

*Bock, Carl E. and Jane H. Bock. 2000. **Effects of Fire on Abundance of Plains Lovegrass in a Semiarid Grassland in Southeastern Arizona.** P. 3 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary indicates long-term abundance of plains lovegrass may depend on episodic fire, particularly during periods of reduced precipitation.

*Bock, Carl E. and Jane H. Bock. 2000. **Response of Winter Birds to Drought and Short-duration Grazing in Southeastern Arizona.** P. 5 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Abstract reports high-density short-duration rotational grazing, coupled with a drought, left the land in a substantially denuded condition through two winters, and this in turn negatively impacted a variety of resident and migratory birds dependent on ground cover and seed production for over-winter survival.

*Bock, Carl E. and Jane H. Bock. 2000. **Shrub Densities in Relation to Fire, Livestock Grazing, and Precipitation in an Arizona Desert Grassland.** P. 4 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary shows that complex interactions between fire, grazing, and rainfall can determine woody plant density in desert grasslands, and that these effects can differ widely among shrub species.

*Bock, Carl E. and Jane H. Bock. 2000. **Vegetative Changes in a Grass/Shrubland after Fifteen Years Without Disturbance.** P. 8 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Preliminary results show that from 1985-2000 total shrub densities have decreased on Bald Hill on the Appleton-Whittell Research Ranch and that exotic lovegrasses are spreading significantly but slowly, despite the absence of fire, grazing, or other disturbance.

**Bock, Carl E. and Jane H. Bock. 2000. *The View from Bald Hill: Thirty Years in an Arizona Grassland.* University of California Press. Berkeley. 197 pgs.

Book describes the beginnings of the Appleton-Whittell Research Ranch and the studies completed over the years to aid the understanding of the ecology of the semi-desert grasslands.

*Bock, Jane H. and Carl E. Bock. 2000, **The Milkweed Project.** P. 7 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing research will result in documentation of the behavior of the small, migratory pollinators (e.g. butterflies, bats and hummingbirds) of the Appleton-Whittell Research Ranch. This will help those concerned with conservation and management of public and private lands to better protect native pollinators whose existence is essential to many species native to the Sonoita Valley grassland.

*Brady, W.W., M.R. Stromberg, E.F. Aldon and C.D. Bonham. 2000. **Response of a Semidesert Grassland to 16 Years of Rest from Grazing.** P. 12 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Abstract outlines the long-term changes in vegetation on the Appleton-Whittell Research Ranch from 1969-1984. The observed changes are consistent with predictions by generally accepted plant-herbivore theory and do not provide evidence supporting theories which emphasize the necessity of continued grazing impact to prevent ecosystem deterioration.

*Bristow, Kirby D. and Richard A. Ockenfels. 2000. **Effects of Human Activity and Habitat Conditions on Mearn's Quail Populations.** P. 59 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Abstract of survey reported that the current National Forest grazing program and the AZ Game and Fish Department's hunting program did not adversely affect the Mearns' quail populations; non-resident hunters had no detectable impact on bird populations relative to resident hunters. Pairing and brood season habitat selection was determined and logistic regression habitat models developed. Options to improve current management data were developed.

*Bristow, K.D. and R.A. Ockenfels. 2000. **Effects of Human Activity and Habitat Conditions on Mearns' Quail Populations.** Arizona Game and Fish Department Research Branch Technical Guidance Bulletin No. 4, Phoenix. 27 pgs.

Technical Bulletin for the Federal Aid in Wildlife Restoration Project describes the study area, the survey methodology, effects of USFS livestock grazing program, potential effects of tree removal, effects of hunting program, and management implications for Mearns' Quail population.

*Chace, J.F. 2000. **Habitat and Host Selection by Sympatric Avian Brood Parasites in Southeastern Arizona.** Annual meeting of the Ecological Society of America, Aug. 6-10, 2000: 70. Univ. of CO, Boulder, CO.

Abstract reports that overall, Brown-headed cowbird parasitism was highest in the low elevation
mesquite forests along the San Pedro River and Bronzed Cowbird parasitism was highest in montane riparian canyons of the Huachuca Mountains.

*Chace, Jameson F., Shawn T. McKinney and Alexander Cruz. 2000. **Nest-site Characteristics and Nesting Success of the Greater Pewee in Arizona.** Southwestern Naturalist 45(2):169-175.

Primary breeding habitats include montane pine-oak forests and sycamore or cottonwood reparian forests. Greater pewees nested in trees that were significantly taller than canopy trees found in non-use sites. A combination of high nest placement and aggressive nest defense may account for the lack of brood parasitism and low rate of nesting failure caused by predation during low predation years.

*Chace, Jameson F., Shawn T. McKinney and Alexander Cruz. 2000. **Monitoring Avian Productivity and Survivorship at Post Canyon Dam.** P. 54-58 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin, AZ. 84 pgs.

Ongoing project established a long-term constant-effort mist-netting monitoring observation of the bird population on the Appleton-Whittell Research Ranch in a cottonwood riparian woodlot of Post Canyon Dam area. This study revealed (1) the diversity of birds that use the site during the breeding season but nest in other habitats exceeds the number of species breeding on the site itself; (2) breeding activity has been confirmed for 18 species and inferred for eleven others, (3) continuation of the project will generate accurate productivity and survivorship estimates, (4) these data will be comparable across the continent in the MAPS program since the minimum of four years of data has been collected.

*Chiszar, David and Hobart Smith. 2000. **Abundance of Herpetofauna on the Research Ranch and on Adjacent Areas of Grazed Land.** P. 41 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Synopsis reported new plant growth on grazed land following the monsoons did not increase the numbers of lizards on these areas compared to the ungrazed lands of the Appleton-Whittell Research Ranch. In the future, the study would like to identify the degree of recovery of plant and insect populations in the grazed habitat that will be needed to support recolonization by lizards.

*Chiszar, David and Hobart M. Smith. 2000. **The Status of Slevin's Bunch Grass Lizard, *Sceloporus slevini*, on the Sonoita Plain.** P. 46 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary reports, possibly because of a two year drought, the lizard *Sceloporus slevini* has disappeared from the Sonoita Plains. Recovery is unlikely unless the continuity of habitat that exists from higher altitude sanctuaries to lowland ones continues to exist.

*Cross, Anne F., Alexander G. Fernald and Jane H. Bock. 2000. **Using Soil Moisture to Assess Ecosystem Function Following Exotic Lovegrass Invasion in Semiarid Grasslands of Southeastern Arizona.** P. 26 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary of study examines whether a semiarid grassland retains its functional integrity following the invasion of an introduced, exotic grass by measuring soil moisture at two depths under plains lovegrass (native species) and Lehmann lovegrass (exotic species). Results show that soil moisture can be used to assess ecosystem function.

*Geiger, Erika L., Jennifer Thieme-McCollom and William V. Branan. 2000. **Geographic Information System at The Research Ranch: A Local and Regional Tool for Conservation Planning.** P. 36 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Synopsis describes the utilization of the GIS system together with maps from various government organizations and information regarding habitat for key herbivores in the area to create a digitalized map of the area to determine remaining habitat and locations where future conflicts might occur. These maps and information provided by the Appleton-Whittell Research Ranch have been employed in a regional planning effort for the Sonoita Valley.

*Gordon, Caleb E. 2000. **Ecology of Wintering Grassland Sparrows.** P. 13-14 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary of three completed research studies and an ongoing research study into the wintering habits and ecology of grassland sparrows includes the effect of spring/summer burning and cattle grazing on the wintering sparrows. Results 1) show fixed home range movements, and within-species constancy of movement behavior across years and study sites are generally the rule, 2) suggest the evolution of facultative migration strategies is linked with unpredictable temporal

variation in spatial distribution of habitat conditions in the landscape, 3) suggest that moderate cattle grazing may be compatible with the conservation of these species, and that Vesper and Savannah sparrows respond positively to fire, while Cassin's sparrows do not.

Gordon, Caleb E. 2000. **Fire and Cattle Grazing on Wintering Sparrows in Arizona Grasslands.** Journal of Range Management 53:384-389.

Spring burning was found to be generally beneficial to wintering grassland sparrows, whereas the effects of cattle grazing were less clear. Limited data suggest that severe grazing appears to have a negative effect on the abundance of the 3 sparrow species of management concern. However, moderate cattle grazing may be compatible with the conservation of these species.

Gordon, Caleb E. 2000. **Movement Patterns of Wintering Grassland Sparrows in Arizona.** The Auk: 117(3):748-759.

With the exception of Savannah Sparrows, movement patterns remained constant within the six grassland species studied across years and study sites despite fluctuations in abundance. Abundance of the most sedentary species, Cassin's, Grasshopper, and Baird's sparrows, was poorly correlated with summer rainfall, whereas the more mobile Savannah, Vesper, and Brewer's sparrows were positively correlated.

*Hass, Christine C. and H. Sheridan Stone. 2000. **Ecology of Hooded Skunks in Southeastern Arizona.** P. 20 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing study of hooded skunks will look at their habitat, competitive interactions among mesocarnivores and possibly on the prevalence of rabies in non-urban striped and hooded skunks.

*Jones, Z.F. 2000. **The Botteri sparrow: An avian habitat specialist colonizing an alien grassland in southeastern Arizona.** Abstract submitted to Cooper Society 2000.

Results of study suggest exotic grasslands may be providing ecological and evolutionary opportunities for a species that otherwise has been and would continue to be narrowly distributed and uncommon.

*Jones, Zach F. and Carl E. Bock. 2000. **The Botteri Sparrow: An Avian Habitat Specialist Colonizing an Alien Grassland in Southeastern Arizona.** P. 50-51 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary of study monitored nesting density of the Botteri Sparrow in three different habitats (Sacaton, native short and mid-height grasses, and Boer lovegrass) to assess habitat preferences and to study how density was related to habitat quality. Data indicates that exotic grasslands may be providing ecological and evolutionary opportunities for a species that otherwise has been and would continue to be narrowly distributed and uncommon.

*Kennedy, Linda J. and William V. Branan. 2000. **Monitoring the Effects of Fire on Semi-arid Grassland and Oak Savannas after Decades of Fire Suppression.** P. 37 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Description of long-term monitoring project that will examine the effects of fire on woody shrubs, cacti and oaks. Paired transects have been established on burned and non-burned (control) sites to assess changes in the composition of the vegetative community. Fuel ladders have been cleared from the base of 1000 oaks (Emory and Arizona white), and the survivorship of these trees will be compared to the survivorship of 1000 control (uncleared) trees.

* **Kennedy, Linda and Stephanie Seltzer, Eds. 2000. *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Book outlines the goals of the Appleton-Whittell Research Ranch (AWRR) reports on 43 recent and on-going research projects, describes the conservation and land management practices, and details education and outreach programs. *ARR 2000* also outlines a 10 year stategy to set the Appleton-Whittell Research Ranch on target for the next 100 years.

*Kennedy, Linda J. and Jean C. Stutz. 2000. **Arbuscular Mycorrhizal Fungi Associated with Big Sacaton (*Sporobolus wrightii).*** P. 30 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary of several projects examining the symbiotic relationahip between big sacaton (*Sporolus wrightii)* and arbuscular mycorrhizal (AM) fungi. Nine species of AM fungi were identified from unburned sacaton on the Appleton-Whittell Research Ranch, including a previously undescribed species which has subsequently received taxonomic treatment and named *Glomus eburneum* Kennedy, Stutz & Morton.

*Lane, Leonard J. and Lainie R. Levick. 2000. **Soil Erosion Prediction and Health of Semi-Arid Ecosystems.** P. 32 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing research is developing the capability to predict the results of soil erosion through the Hillslope Erosion Model to give decision-makers the ability to evaluate management alternatives before the soil resources are at risk.

Mathies, Tom, Robin M. Andrews. 2000. **Does Reduction of the Eggshell Occur Concurrently with or Subsequent to the Evolution of Viviparity in Phrynosomatid Lizards?** Biological Journal of the Linnean Society. 71: 719-736.

Despite major differences among species in the capacity to support embryogenesis, shell morphology (structure, thickness) and physiology (permability to water vapour) did not vary as predicted.

*McElroy, S. (editor). 2000. *San Pedro Conference Proceedings: Divided Waters - Common Ground: Cananea, Sonora and Bisbee, AZ.* Proceedings of November 1999 conference sponsored by SALSA (Semi-Arid Land-Surface-Atmospere Program), 113 pgs. 2 CD's.

The future well-being of the San Pedro Watershed and River depends on the willingness of all resource users on both sides of the Mexico-U.S. border to share knowledge and information about the area. Open dialogue will enable both sides to reach an equitable means of preserving the unique habitat and the communities of the Upper San Pedro River Basin.

*McLaughlin, Steven P. and Janice E. Bowers. 2000. **Species Richness of Southeastern Arizona Grasslands and Oak Savannas at Different Scales.** P. 9-10 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Three scales (landscape, community and point) were compared to determine the relationship of species richness on grassland and oak savanna in southeastern Arizona.

*McLaughlin, Steven P., Erika L. Geiger and Janice E. Bowers. 2000. **Flora of the Appleton-Whittell Research Ranch.** P.1 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

471 native species and 38 exotic species were found on the Appleton-Whittell Research Ranch (AWRR). The composites (Asteraceae), grasses (Poaceae) and legumes (Fabaceae) accounted for 46% of all species. Many species at the AWRR are also found in mid-elevation grasslands in the Mexican states of Chihuahua and Coahuila. The existing herbarium collection at the AWRR was updated. This supersedes previous lists of flora (1997,1998,1999). Updates are available on the website: www.AudubonResearchRanch.org

*Miller, Jay D. 2000. **Modeling Fire in Semi-desert Grassland/Oakland: The Spatial Implications.** P. 34-35 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Modeling of fire provides a way to estimate and to quantify fire behavior and to predict fire behavior based upon environmental variables. Detailed fuel models and map resolution were found to produce statistically different fire areas than when using generic fuel models mapped at a coarse scale. This study will help land managers to base decisions about the effectiveness of

detailed fuel mapping in modeling fire spread and whether the additional cost of detailed mapping is offset by improved accuracy of modeled fire behavior.

O'Dea, Mary E. 2000. **Arbuscular Mycorrhiza: A Linkage of Plant, Soil and Surface Hydrologic Processes in a Southwest Grassland.** PhD Dissertation with a Major in Watershed Management. U. of AZ, Tucson. 121 pgs.

A three year field study quantified the integrated effects of prescribed fire and the summer monsoon on the plant and fungal communities, soil structure and surface hydrology of an Arizona savanna. Results indicate that a feedback mechanism exists between the plant community and biotic and physical soil processes, which when disturbed affect the hydrology of the hillslope. There were also clear differences among the various grasses' response to fire and monsoons. Prescribed fire showed both a significant and negative impact on AMF infection potential within and among the species examined. In addition, the fungal properties of the soil, and not levels of soil organic matter, appeared to influence the characteristics of the soil structure, which created measurable changes in both runoff and upland erosion processes.

*O'Dea, Mary, D. Phillip Guertin and C.P. Patrick Reid. 2000. **Arbuscular Mycorrhiza: A Linkage of Plant, Soil and Surface Hydrologic Processes in a Southwest Grassland.** P. 21-22 *in* (Linda *Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Synopsis explains the study done to evaluate the effects of a late spring prescribed burn and a simulated rainfall event associated with the summer monsoon on the functioning and interchange between plant, soil and hydrologic processes within a desert grassland. The role of arbuscular mycorrhizal fungi was also examined as a common and functional linkage between plant and soil processes, and as an indirect mediator of surface hydrology.

*Ortiz-Barney, Elena and Julie C. Stromberg. 2000. **Spatial Distribution of Seeds in Grasslands of Different Quality and Their Potential Tolerance to Prescribed Burning: A Work in Progress.** P. 11 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing study is examining the effect grassland degradation has on the soil seed bank reserves, where the majority of seeds are found within the landscape (in the soil or in the top litter) and how these seeds will tolerate grassland or shrubland burning.

*Qi, Jiaguo, Robin Marsett, Sharon Biedenbender, Philip Heilman and M. Carolyn Watson. 2000. **RANGES.** P. 38 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Researh Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary of a study to evaluate the use of remote sensing products, including temporal thematic maps of green vegetative cover, brown vegetative cover, and biomass indicators using the Landsat TM imagery, to address production and degradation issues on rangeland.

Richardson, David M., Petr Pysek, Marcel Rejmanek, Michael G. Barbour, F. Dane Panetta , Carol J. West. 2000. **Naturalization and Invasion of Alien Plants: Concepts and Definitions.** Institute for Plant Conservation, Botany Department, University of Cape Town, Rondebosch 7701, South Africa.

Much confusion exists regarding terms on plant invasions as defined by various authors in the English-based literature. Based on an extensive survey , a minimum set of key terms (**introduction, naturalization,** and **invasion)** related to a graphic scheme which conceptualizes the naturalization/invasion process are defined and recommended for widespread application and acceptance.

*Ruth, Janet M. 2000. **Wintering Habitat Use by Priority Grassland Birds.** P. 42-43 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing project examines the types of habitat preferred by target wintering grassland bird species and the effects of grazing on vegetation structure and floristic characteristics, as well as on bird populations. This study uses two approaches to bird surveying of standard transects over a period of time.

*Sellers, Chris and Anne F. Cross. 2000. **Oak Species Influence on Soil Resource Distribution in South-eastern Arizona Soils.** P. 27 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary describes how individual shrubs influence the spatial distribution of soil resources in an arid and semiarid ecosystem. Data indicate oak trees do influence the distribution of some soil resources in an oak-savanna ecosystem.

*Seltzer, Stephanie, John Briggs and Linda Kennedy. 2000. **Mapping of Boer Lovegrass, Lehmann Lovegrass, and Coastal Bermuda on The Research Ranch.** P. 33 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing project will quantify the extent to which 3 non-native species (Boer lovegrass, Lehmann lovegrass, and coastal Bermuda) have established themselves on the Appleton-Whittell Research Ranch to form a baseline for future comparisons of spread, recession and movement of these grass species. Maps are generated by using a Trimble TSC1 Asset Surveyor, GPS Pathfinder Office software, and ArcView.

*Sisk, Thomas, Timothy Crews and Lauren Golten. 2000. **Effects of Livestock Management on Ecosystem Productivity and Biological Diversity in Southwestern Grasslands.** P. 31 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Results from a pilot study done after two consecutive drought years showed that aboveground, net primary productivity was significantly higher at the ungrazed site (the Appleton-Whittell Research Ranch) compared to the traditional and HRM managed ranches whereas plant species diversity did not vary significantly as a function of livestock management. The aim of a proposed study is to bridge the existing gulf between research science, ranchers, other land managers, and the public.

*Skroch, Matt. 2000. **Long-Term Wildlife Monitoring Using Trained Volunteers and Track Transects.** P. 39-40 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ 84 pgs.

The Wildlife Tracking Program of the Sky Island Alliance gathers data of valley corridors and historic dispersal/migration routes of wildlife in the southwestern U.S. and northwestern Mexico. Over time, statistical analysis of the data will provide further insight into wildlife movements and the need for protection of such areas.

*Smith, Hobart M., Carl E. Bock and J.H. Bock. 2000. **The Effect of Livestock Grazing upon Sleven's bunch Grass Lizard.** P. 44 in (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

More Slevin's bunch grass lizards were found on the Appleton-Whittell Research Ranch than on adjacent grazed land. Results indicate the previous assumption that this species is limited to higher elevations, 7000-10,000 feet, was due to the effect of grazing, rather than elevation.

*Smith, Hobart M. and David Chiszar. 2000. **The Helminth Fauna of The Bunch Grass Lizard, *Sceloporus slevini*.** P. 47 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

A comparison of helminth fauna from two studies notes differences between cestodes and nematodes in bunchgrass lizards from the Chiricahua Mts. and the Appleton-Whittell Research Ranch.

*Smith, Hobart M. and David Chiszar. 2000. **The Herpetofauna of the Research Ranch.** P. 48-49 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Current list of the 44 species known or thought to occur on the Appleton-Whittell Ranch has been updated to incorporate changes in taxonomy and nomenclature.

*Smith, Hobart M. and David Chiszar. 2000. **The Mystery *Sceloporus* of the Environs of the Research Ranch.** P. 45 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ 84 pgs.

Summary describes unsuccessful attempts to collect specimens of an unknown lizard species found on and near the Appleton-Whittell Research Ranch.

*Stromberg, J., D. Patten, J. Stutz, R. Tiller. 2000. **Autecology and Restoration of *Sporobolus wrightii* Riparian Grasslands in Southern Arizona.** Final report to Arizona Water Protection Fund Commission, Contract 95-018WPF. December 2000. 301 pgs.

Report included results of sacaton studies in germination and seedling dynamics, mycorrhizal ecology, community and water relations, restoration and natural recovery . Information on the data base and web site of the ecology and recovery potential of sacaton is given.

Stromberg, Mark R. 2000. **Habitat, Movements and Roost Characteristics of Montezuma Quail in Southeastern Arizona.** P. 17 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Montezuma Quail forage mostly on north-facing hillsides, 20 m from oak trees in sites of native bunch grasses. Coveys roost at night in patches of tall grass on southeast hillsides. Grazing that removes more than about half of the grass that grows each year will eliminate the habitats needed by these quail. Very little is known of population fluctuation in response to climate, habitat changes, or other wildlife management options because the birds are so difficult to census.

*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.

Compilation of data from articles and research studies describes the distribution, systematics, migration, habitat, food habits, sounds, behavior, breeding, demography and populations, conservation and management, appearance, measurements of Montezuma Quail, and suggests priorities for future research.

*Tiller, Ronald L., Linda J. Kennedy, Brantlee Spakes, Juliet C. Stromberg, Jean C. Stutz and Duncan T. Patten. 2000. **Ecology of *Sporobolus wrightii* (Big Sacaton): Implications for Restoration and Management of Riparian Grasslands in Southwestern North America.** P. 16 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Abstract describes the multi-year study being done on extant and former sacaton grasslands to understand ecological processes, variables, and relationships influencing regeneration and maintenance of these grasslands. Knowledge gained from field studies and from laboratory and greenhouse experiments is being tested in field restoration efforts in abandoned agricultural lands.

*Tiller, R.L., K.A. Snyder, D.G. Willims, J.C. Stromberg. 2000. **Water Source Use of a Riparian Tallgrass, Big Sacaton *(Sporobolus wrightii),* along a Gradient of Depth to Groundwater and Rainfall Regime in Southeastern Arizona.** P. 219 *in* Abstracts of the 85th Annual Meeting of the Ecological Society of America. August 6-10, 2000. Snowbird, UT.

Abstract indicates big sacaton uses rainwater and/or groundwater depending on availability and site conditions.

*Tiller, R.L., B.E. Spakes, L.J.Kennedy, J.C. Stromberg, J.C. Stutz, D.T. Patten. 2000. **Ecology of *Sporobolus wrightii* (Big Sacaton): Implications for Restoration and Management of Riparian Grasslands in Southwestern North America.** P. 95-96 *in* San Pedro Conference Proceedings: Divided Waters-Common Ground: Cooperative Research and Management of Bi-National Resources in the Upper San Pedro Basin of Sonora and Arizona. November 8-10, 2000. Cananea, Sonora, Mexico and Bisbee,AZ, USA. (poster)

Poster describes multi-year study to protect the greatly diminished scacton grassland community.

*Tiller, R.L., B.E. Spakes, L.J.Kennedy, J.C. Stromberg, J.C. Stutz, D.T. Patten. 2000. **Ecology of *Sporobolus wrightii* (Big Sacaton): Implications for Restoration and Management of Riparian Grasslands in Southwestern North America.** The First Annual Information Transfer on Riparian and Stream Restoration in Arizona. March 22-23, 2000. Phoenix, AZ. (poster).

Poster describes multi-year study being undertaken to acquire the ecological information necessary to understand the processes, variables, and relationships that allow for regeneration and maintenance of sacaton grasslands.

*Turner, Raymond M. and Jeanne B. Turner. 2000. **Photographic Documentation of Vegetation Change at the Research Ranch.** P. 24-25 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary lists 14 permanent camera stations established at the Appleton-Whittell Research Ranch from 1974 through 1995 and tells where the photographs/negatives are archived. Repeat photographs are planned at least at 10 year intervals in order to document future changes resulting from management actions.

*Wallace, J. Eric and Philip C. Rosen. 2000. **The Mexican Garter Snake and Chiricahua Leopard Frog in the Sonoita Grasslands of Southeastern Arizona.** P. 52-53 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Preliminary results of this survey indicates Mexican garter snakes persist in the area but are fewer in number than in 1988 because of expansion of exotics (bullfrogs, crayfish, and predatory fishes). Populations of Chiricahua leopard frogs have also declined in numbers, but continue to persist at the Appleton-Whittell Research Ranch and adjoining lands. Study continues to observe and describe details of the interactions of landscape structure, habitat type, and life historical conditions that may assist recovery of Chiricahua and lowland leopard frogs despite the threat of proprietory exotic species.

*Whitcomb, Robert, Steven McLaughlin and K.G.A. Hamilton. 2000. **Effect of Seasonality on Host Relationships of Leafhoppers (Homoptera: Auchenorrhyncha) in Southeast Arizona Grasslands.** P. 28-29 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Ongoing study is developing a complete list of the leafhopper fauna of the Appleton-Whittell Research Ranch annotated with the hosts from which the species were collected. Each insect species must make a commitment to either a host or a season, must time its development period to coincide with that of the host, and must develop some means for survival when its host is unavailable. Study of the leafhopper may lead to understanding the effect of an unusual season on leafhopper-host relationships and discovering the means used by leafhopper species to endure the dry season.

*Widmer, Kristen A. and Mitchell P. McClaran. 2000. **Inflorivory of Palmer Agave in Relation to Livestock Management.** P. 15 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary shows that inflorivory (grazing of flower stalks) of Palmer Agave was 44% greater in grazed versus ungrazed areas at 0.4-0.8 km from drinking water.

*Woods, Christopher P. 2000. **Ecological Aspects of Torpor Use and Winter Dormancy by Common Poorwills.** P. 18-19 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

Summary describes the method to study body temperature of Poorwills (capture by mist netting and outfitting with temperature-sensitive radio transmitters) at three different sites to resolve uncertainties regarding the nature of torpor by Poorwills, and the extent to which individuals remain torpid during winter. 50 degrees F seems to prepare the Poorwills for oncoming torpid periods and as temperatures drop further (and insects also become scarce) Poorwills are likely to use torpor.

*Zahn, Laura M. 2000. **Population Dynamics of the Gynodioecious *Bouteloua chondrosioides* (Spruce-top Grama).** P.2 *in* (Linda Kennedy and Stephanie Seltzer, editors) *Audubon Research Ranch 2000.* National Audubon Society Appleton-Whittell Research Ranch. Elgin AZ. 84 pgs.

This dissertation abstract focuses on investigations of the mating system in the gynodioecious perennial, *Bouteloua chondrosioides* (spruce-top grama) (Poaceae) that has varying levels of male sterility among populations.

1999

Andrews, Robin M. Tom Mathies, Carl P. Qualls, Fiona J. Qualls. 1999. **Rates of Embryonic Development of *Sceloporus* Lizards: Do Cold Climates Favor the Evolution of Rapid Development?** Copeia 3: 692-700.

Developmental rates of *Sceloporus* are lineage specific and do not appear to be adapted to local climates.

*Bock, Carl E. and Jane H. Bock. 1999. **Response of Winter Birds to Drought and Short-Duration Grazing in Southeastern Arizona.** Conservation Biology, Volume 13, No. 5, October 1999: 1117-1123.

High density, short-duration rotational grazing, coupled with a drought, left the land in a substantially denuded condition through two winters (1995-1996) and negatively affected a variety of resident and migratory birds dependent on ground cover and seed production for over-winter survival.

Gordon, Caleb E. 1999. **Community Ecology and Management of Wintering Grassland Sparrows in Arizona.** PhD. Thesis, Department of Ecology and Evolutionary Biology. U. of AZ,, Tucson. 80 pgs.

Four year field study of the movement patterns, community dynamics and management of granivorous winter grassland sparrows showed: 1) strong interspecific differences in movement; 2) facultative migration strategies may be the rule in grassland sparrows; and 3) moderate cattle grazing may be compatible with the conservation of *Ammodiamus* sparrows.

*Kennedy, Linda J. 1999. **Mycorrhizal Ecology of *Sporobolus wrightii*.** Ph.D Dissertation. Department of Plant Biology. Arizona State U. Tempe. 105 pgs.

Sporobolus wrightii forms symbiotic relationships with arbuscular mycorrhizal fungi (AMF). Extent of colonization by AMF varies on a seasonal basis and is influenced by edaphic conditions. Seedlings inoculated with AMF from a lower floodplain terrace show a slight increase in biomass, compared to uninoculated controls. Species richness of AMF ranged from 3 to 9 per site, with 15 total AMF species identified. Two undescribed species received taxonomic treatment, *Glomus luteum* and *G. eburneum.*

*Kennedy, L.J., J.C. Stutz, J.B. Morton. 1999. ***Glomus eburnum* and *G. luteum*, Two New Species of Arbuscular Mycorrhizal Fungi, with Emendation of *G. spurcum*.** Mycologia, 91 (6), 1999. pp. 1083-1093.

Two new species of arbuscular mycorrhizal fungi, *Glomus eburneum* and *G. luteum* are described. Spores of *G. eburneum*were associated with roots of giant sacaton, *Sp. Wrightii,* a native species of grass found only along rivers and streams of the semiarid regions of southwestern North America.

*Kunz, Michael. 1999. **Mechanisms Contributing to the Alteration in Community Structure by the Exotic *Eragrostis chloromelas* (Boer Lovegrass) in a Desert Grassland.** M.A. Thesis. Department of Environmental, Population, and Organismic Biology, U. of CO. Boulder. 52 pgs.

Boer lovegrass has the ability to alter community structure by 1) controlling the seed rain and seed bank inside the exotic stands, 2) possibly out-competing native species, and 3) having the potential to spread into the surrounding desert grassland. It continues to be a threat to the ecological integrity of the native grasslands in the Southwest.

*Miller, J.D. 1999. **Modeling Fire in Semi-desert Grassland/Oak Woodland: The Spatial Implications.** M.A. Thesis, Department of Geography and Regional Development, U. of AZ. Tucson. 159 pgs.

Study of predictive fire behavior modeling describes the variability in modeled fire behavior in southeastern Arizona due to weather, the level of spatial detail of the fuels map, and the use of custom fuel models using fire behavior model *FARSITE*. Accurate mapping of fuels can improve the accuracy of fire behavior modeling. Improvement depends on spatial resolution of the fuels data and differences between the custom fuel models and the Northern Forest Fire Laboratory (NFFL) models.

Ruth, Janet. 1999. **BRD Conservation the USGS Way.** Bird Conservation 1999. Pg. 13.

Because wintering grassland birds have shown steeper, more consistent and widespread declines than any other guild of North American species, it is important to study their habitat preferences, the plant community composition and their relationship to bird abundance as well as to study the effects of cattle grazing on wintering grassland birds by comparing bird communities on grazed and ungrazed sites. Two approaches, using many volunteers, have been used: 1) transect surveys and 2) flush-netting.

*Tiller, R.L., J. Fonseca, D. Gori, D. Backer, K. Fox, E. Wilk, J. Cooper, J.C. Stromberg. 1999. **Revegetation of Big Sacaton *(Sporobolus wrightii)* into Abandoned Agricultural Fields in Southeastern Arizona.** P. 123 *in* Program and Abstracts of the Eleventh Annual Conference of the Society for Ecological Restoration. September 23-25, 1999. San Francisco, CA.

Abstract indicates positive effect of irrigation on growth and survivorship for transplants on sites with greater depth to groundwater, but effects of container size remain unclear.

*Tiller, R.L., L.J. Kennedy, B.E. Spakes, J.C. Stromberg, J.C. Stutz and D.T. Patten. 1999. **Ecology of *Sporobolus wrightii* (big sacaton): Implications for Restoration and Management of Riparian Grasslands in Souhwestern North America.** Poster abstract. San Pedro Conference: Divided Waters-Common Ground, Nov. 7-10, 1999. Cananea, Sonora/Bisbee, AZ.

Multi-year study is in progress to acquire ecological information necessary to understand processes that allow for regeneration and maintenance of Sacaton grasslands. This includes laboratory and field studies to determine requirements for seed germination, seedling emergence and survivorship, and elucidation of mycorrhizal relationships.

*Tiller, R.L., L.J. Kennedy, J.C. Stromberg, J.C. Stutz. 1999. **Factors Affecting Germination, Emergence and Seedling Growth of *Sporobolus wrightii* in Controlled Environments.** 43rd Annual Meeting of the Arizona Nevada Academy of Sciences. April 17, 1999. Flagstaff, AZ. Journal of the Arizona-Nevada Academy of Science 34 (supplement, abstract): 13.

Abstract suggests sacaton seeds germinate in greatest abundance during the late-summer monsoon season, and seedlings have greatest success in floodplain environmenta that allow for deposition of fine-grained sediments.

*Tiller, R.L., B.E. Spakes, L.J. Kennedy, J.C. Stromberg, J.C. Stutz, D.T. Patten. 1999. **Ecology of *Sporobolus wrightii* (Big Sacaton): Implications for Restoration and Management of Riparian Grasslands in Southwestern North America.** Eleventh Annual Meeting of the Society for Ecologicl Restoration. September 22-25, 1999. San Francisco, CA. (poster)

Poster describes multi-year study being done on extant and former sacaton grasslands to better understand ecological processes, variables, and relationships influencing regeneration and maintenance of sacaton.

*Tiller, R.L., B.E. Spakes, L.J. Kennedy, J.C. Stromberg, J.C. Stutz, D.T. Patten. 1999. **An Ecological Study of *Sporobolus wrightii* (Big Sacaton) Riparian Grasslands in Southeastern Arizona: Implications for Management and Restoration.** 12th Annual Meeting of the Arizona Riparian Council. April 28, 1999. Flagstaff, AZ. (poster)

Abstract indicates strong mutualistic relationship between big sacaton and arbuscular mycorrhizal (AM) fungi. Pre-inoculation of greenhouse-grown sacaton has shown potential to benefit transplants.

1998

Branan, Bill. 1998. **Use of Volunteers in Land Management. P. 258 *in* (Barbara Tellman, Deborah Finch, Carl Edminster and Robert Hamre, editors) *The Future of Arid Grasslands: Identifying Issues, Seeking Solutions..* Proceedings of October 9-13, 1996 conference. Rocky Mountain Research Station. Rocky Mountain Research Station. Fort Collins CO. 392 pgs.

Volunteers are a valuable asset by providing assistance in research as well as maintenance, construction work and office help.

*Bock, Carl E. and Jane H. Bock. 1998. **Factors Controlling the Structure and Function of Desert Grasslands: A Case Study from Southeastern Arizona.** P. 33-44 *in* (Barbara Tellman, Deborah Finch, Carl Edminster and Robert Hamre, editors) *The Future of Arid Grasslands: Identifying Issues, Seeking Solutions.* Proceedings of October 9-13, 1996 conference. Rocky Mountain Research Station. Fort Collins CO. 392 pgs.

28 years' research at or adjacent to the Appleton-Whittell Research Ranch shows: 1) grazing reduces grass cover and fire frequency, while encouraging shorter-stature grasses and wildlife typical of lower elevation desert sites; 2) fires cause temporary declines in grass cover and some shrubs, and temporary increases in herbs and seeds, while favoring birds, rodents, and insects dependent on seeds and preferring more open habitats; 3) droughts cause temporary declines in shrubs, certain herbs and grasses, and associated wildlife. Plains lovegrass appears to survive drought better if it has recently burned. Future integrity of the site depends upon reversing the spread of the exotic African lovegrasses.

*Kennedy Elliott, Linda, Jean C. Stutz, Ronald L. Tiller and Juliet C. Stromberg. 1998. **Arbuscular Mycorrhizal Fungi, a Possible Tool for Restoration of Giant Sacaton Grasslands.** P. 319-322 *in* (Barbara Tellman, Deborah Finch, Carl Edminster and Robert Hamre, editors) *The Future of Arid Grasslands: Identifying Issues, Seeking Solutions.* Proceedings of October 9-13, 1996 conference. Rocky Mountain Research Station. Fort Collins CO. 392 pgs.

Ongoing study 1) examined the levels of AM fungal colonization within giant sacaton roots from different habitats, and at different phenological stages of the host plant (*Sporobolus wrightii* on lower floodplain terraces exhibited greater total AM fungal colonization compared to plants on upper terraces); 2) identified AM fungal species present in the rhizosphere of giant sacaton. (Living cultures of AM fungal populations from each site have been established which may be used as inoculum for additional restoration research); (3) will quantify effectiveness of AM fungal inoculation of Giant Sacaton.

*McLaughlin, S.P., E.L. Geiger, J.E. Bowers. 1998. **Flora of The Research Ranch: Working Checklist.** Updated October 30, 1998. Unpubl.

The flora of the Appleton-Whittell Research Ranch, listed by botanical names, is available on www.audubonresearchranch.org

***+**Tellman, Barbara, Deborah Finch, Carl Edminster and Robert Hamre, Eds. 19. *The Future of Arid Grasslands: Identifying Issues, Seeking Solutions.* Proceedings of October 9-13, 1996 conference. Rocky Mountain Research Station. Fort Collins CO. 392 pgs.

Book records the presentations of 74 representatives from private ranchers and other private landowners, non-profit groups (such as The Nature Conservancy and NAS-TRR), governmental agencies with responsibility for grassland management, environmental advocates, economists, scientists, and others who were brought together to try and resolve conflicts in non-confrontational ways. The emphasis was on practical, hands-on management methods under a variety of techniques.

*Naeser, Robert and Anne St. John. 1998. **Water Use and the Future of the Sonoita Valley.** P. 186-200 *in* (Barbara Tellman, Deborah M. Finch, Carl Edminster and Robert Hamre, editors) *The Future of Arid Grasslands: Identifying Issues, Seeking Solutions.* Proceedings of conference Oct.9-13, 1996 conference. Rocky Mountain Research Station. Fort Collins CO. 392 pgs.

Available information on the local (Sonoita Valley) water resources leads to the conclusions: 1) groundwater is the only available source of water for both environmental and human needs, 2) groundwater is not found uniformly or predictably throughout the valley, 3) siting developments without a careful hydrologic assessment can result in water scarcity for individual property owners as well as interfere with the recharge of the basin, 4) periods of drought may result in a lowering of

local water tables. Results of the safe yield density study indicate that in Area 1, the minimum lot size should be 12.26 acres.

*Smith, H.M., D. Chiszar, A. Chiszar, D.L. Auth, J. Auth, C. Henke, C.E. Bock, J.H. Bock, J.A. Rybak, R. L. Holland, K. Bonine, G.J. Watkins-Colwell. 1998. **Slevin's Bunch Grass Lizard *(Sceloporus slevini)* Decimated on the Sonoita Plain, Arizona.** Herpetological Review 29(4): 225-226.

From about 1965 to 1997 *Sceloporus slevini* occurred widely in grasslands at relatively low altitudes in southeastern Arizona but disappeared after 1997 possibly because of extended severe drought and concurrent stunting of bunch grass. Differential susceptibility to drought may contribute to its presumed adaptation as a species to relatively high altitudes.

*Veblen, Kari. 1998. **Native Plant Restoration in *Eragrostis chloromelas.*** Honors thesis. Department of EPO Biology, U. of Co., Boulder. 27 pgs.

Burning, addition of lime to the soil, mowing treatments and combinations of these treatments may aid in reestablishment of native plant communities in stands of the African Boer lovegrass.

1997

*Bock, Carl E. and Jane H. Bock. 1997. **Shrub Densities in Relation to Fire, Livestock Grazing and Precipitation in an Arizona Desert Grassland.** Southwestern Naturalist 42 (2): 188-193.

Baccharis pteronioides recovered completely after a 1987 wildfire; *Haplopappus tenuisectus* did not. Both species were most abundant in areas protected from grazing and both species increased after 2 wet winters, declined during dry periods. Over 13 years, *Baccharis* was stable, but *Happlopappus* density increased by more than 2 orders of magnitude.

*DeBano, S.J. 1997. **The Effect of Ecological Disturbance Caused by Livestock Grazing on the Ecology, Morphology, Physiology, and Behavior of the Rainbow Grasshopper, *Dactylotum variegatum.*** Ph.D. Thesis, Department of Entomology. U. of KY, Lexington. 211 pgs.

Insect communities at grazed and ungrazed sites showed no differences in abundance, richness or diversity but species composition was different. Densities of *D. variegatum* were lower on grazed sites and their spacial distribution differed, but sex ratios and stage distribution did not. Neither levels of energy or fluctuating asymmetry differed in individuals from grazed and ungrazed sites.

*Hubbard, J.A., G.R. McPherson. 1997. **Acorn Selection by Mexican Jays: a Test of a Tri-trophic Symbiotic Relationship Hypotheses.** Oecologia 110: 143-146.

Tri-trophic symbiotic relationship between oaks, jays and weevils is not supported by this study; rather it supports the co-adapted symbiotic oak-jay relationship.

*Tiller, R.L., J.C. Stromberg, D.T. Patten, J.C. Stutz, L. Kennedy. 1997. **Seed Ecology of *Sporobolus wrightii* Riparian Grasslands in Southern Arizona.** Society of Wetland Scientists. June 1-6, 1997. Bozeman, MT.

Abstract reports on results of on-going studies exploring variables influencing seed germination, seedling emergence, and seed bank ecology of current and former sacaton grasslands in order to get insight into the autecology of big sacaton and its cohabiting species.

1996

+Bahre, C.J. and M.L. Shelton. 1996. **Rangeland Destruction: Cattle and Drought in Southeastern Arizona at the Turn of the Century.** J. of the Southwest 38 (1): 1-22.

Recurring droughts and overstocking the open range led to huge cattle die-offs and degraded range conditions during the droughts of 1891-93 and 1898-1904. Since then, because of more efficient transportation, increased supplemental feeding, greater water development, and improved cattle marketing, droughts no longer exact major cattle die-offs on the range.

*Mathies, T., R.M. Andrews. 1996. **Extended Egg Retention and its Influence on Embryonic Development and Egg Water Balance: Implications for the Evolution of Viviparity.** Physiological Zoology 69(5): 1021-1035.

The pattern of embryonic development within retained eggs does not support the hypotheses 1) that oviposition occurs when gas exchange in utero is no longer sufficient to support needs of the embryos, or 2) that increase in the duration of egg retention and decrease in eggshell thickness evolve concurrently.

+Ruth, J. 1996. **Declining Birds in Grassland Ecosystems: A Department of the Interior Conservation Strategy.** Report to: Department of Interior. Dec. 11-12, 1996.

The report identifies the most important DOI information needs and funding requirements associated with conservation of Central Grassland birds that are ecologically restricted to upland habitats. The final outcome will be to identify causes of grassland bird declines and to address them through better management.

1995

+Bahre, C.J. 1995. **Human Impacts on the Grasslands of Southeastern Arizona.** P. 230-264 *in* (M.P. McClaran and T.R. VanDevender, editors) *The Desert Grassland.* U. of AZ Press, Tucson. 346 pgs.

Records of land-use by prehistoric Amerindians and Hispanics before 1870 are meager. Since then, records show: 1) increase in brush, scrubby trees and nonnative plants, 2) decline in native grasses, 3) clearing of land for urban and rural development. No area of southeastern Arizona grasslands is without human influence. Good bibliography.

*Bock, C.E., J.H.Bock, M.C. Grant, T.R. Seastedt. 1995. **Effects of Fire on Abundance of Plains Lovegrass (*Eragrostis intermedia)* in a Semi-arid Grassland in Southeastern Arizona.** J. of Vegetation Science 6: 325-328.

Long term abundance of plains lovegrass may depend on episodic fire, particularly during periods of reduced precipitation.

*Hubbard, J.A. 1995. **Mechanisms of Lower Treeline Shift: Seed Fate of *Quercus emoryi* Acorns.** M.S. Thesis, School of Renewable Natural Resources. U. of AZ, Tucson. 48 pgs.

The primary constraint on downslope lower treeline movement may be determined by abiotic factors such as droughts, low soil moisture or temperature extremes. Seed predation is not a primary constraint.

McPherson, Guy R. 1995. **The Role of Fire in the Desert Grassland.** P. 130-151 *in* (Mitchel P. Mc Claran and Thomas R. Van Devender, editors) *The Desert Grassland.* University of Arizona Press, Tucson. 346 pgs.

Fires exert long-term impacts on desert grassland structure and function. Periodic fires maintain grasslands in a relatively shrub-free state; the resulting structure is less verticaly complex, nutrients cycle more rapidly between above-and belowground biomass, and plant growth is more readily available to grazers. The long term absence of fire may produce irreversible changes in structure and function of desert grasslands. The effects of other biological, managerial, political, and climatological factors my either accelerate or counteract the effects of declining livestock numbers and the introduction of nonnative plant species.

*Mathies, T., R.M. Andrews. 1995. **Thermal and Reproductive Biology of High and Low Elevation Populations of the Lizard, *Sceloporus scalaris:* Implications for the Evolution of Viviparity.** Oecologia 104:101-111.

Low temperatures during gestation of the female lizard at high elevations led to a reduction of eggshell thickness, reduced clutch size, and a longer period of egg retention, all indications of presumed intermediate stages in the evolution of viviparity in squamate reptiles.

1994

*Bock, C.E., J.H. Bock. 1994. **Effects of Predator Exclusion on Rodent Abundance in an Arizona Semidesert Grassland.** Southwestern Naturalist 39(2): 208-210.

Rodent numbers increased where bobcats, coyotes, hawks, owls, rattlesnakes and other predators were excluded from a semidesert grassland.

Branan, William V. 1994. **From the Other Side of the Fence. Range Magazine, Spring 1994: 34-37.

Cooperative research should seek to safeguard rangelands, restore water resources, increase wildlife and natural communities, and enhance our quality of life. Those who press a personal agenda, with misleading terms, assertions, and non-representative photos, needlessly polarize ranchers and environmentalists.

Dagget, D. 1994. **Teaching Fence. Range Magazine: Winter 1994: 18-20.

The Appleton-Whittell Research Ranch provides an opportunity to study grasslands as to how they respond to two totally different styles of management -- complete rest and intensive grazing.

*Finberg, K.O. 1994. **Community Structure Changes in a Grassland after a Wildfire and a Dry Season.** M.A. Thesis, Landscape and Architecture. AZ State U., Tempe. 102 pgs.

Some of the earliest research noted that fires ceased after grazing began. In the last 35 years, fire has been recognized as one of the cyclical disturbances that perpetuate a grassy landscape. The short-grass community's response immediately after the fire was similar to that often cited in the literature: total cover declined and African midgrass invaded. As monitoring continued during growing seasons, the site transformed to a mixed-grass community -- a transformation that included continued increase in African midgrasses.

Neary, J. 1994. **In the Land of the Apaches. Audubon: May-June 1994: 104-109.

Article discussed history and objectives of the Appleton-Whittell Research Ranch and how the Apacheria Project addresses current challenges of the semi-desert grassland bioregion.

1993

+Bahre, C.J. and M.L. Shelton. 1993. **Historic Vegetation Change, Mesquite Increases, and Climate in Southeastern Arizona.** Journal of Biogeography 20: 489-504.

Except possibly for increases in woody xerophytes such as mesquite, all of the identified long-term vegetation changes appear to be of anthropogenic origin. Mesquite increases, however, are irregular, show no clear relation to precipitation variations, and are most likely the result of livestock grazing and/or fire exclusion.

Biedenbender, S. 1993. **Fire Ecology of Lehmann Lovegrass (*Eragrostis lehmanniana* Nees*): Implications for Native Grassland Restoration in Southeast Arizona. Paper written for Dr. Malcolm Zwolinski. 11 pgs.

Prescribed burning is a useful tool to restore and maintain native grasslands if native grasses have declined, shrubs have increased, Lehmann lovegrass is <u>not</u> present, and fire intensity does not kill mature native grass plants. Grazing can also be used to alter plant composition by coordinating natural selectivity of livestock with periods of active growth of desirable and undesirable species.

Bock, C.E., J.H.Bock. 1993. **Cover of Perennial Grasses in Southeastern Arizona in Relation to Livestock Grazing. Conservation Biology 7: 371-377.

Total grass canopy cover was greater on ungrazed grasslands. Eight bunchgrass species also grew taller on ungrazed areas -- the three tallest species (*Bouteloua curtipendula*, *Bothriochloa barbinodis,* and *Eragrostis intermedia*) showed the greatest increase on ungrazed areas. Two short stoloniferous species (*Hilaria belangeri* and *Bouteloua eriopoda*) were the only taxa substantially more abundant on grazed areas. *Bouteloua gracilis*, the most abundant grass in the region, showed an intermediate response to release from grazing. Livestock grazing appeared to be an exotic ecological force in these southwestern grasslands, and one destructive of certain components of the native flora and fauna.

Bock, C.E., J.H. Bock. 1993. **Effects of Long Term Livestock Exclusion in a Semiarid Grassland. Pp.123-133 *in* (P.G.Rowlands, C.Riper III, and M.K.Sogge, editors) *Proceedings of the First Biennial Conference on Research in Colorado Plateau National Parks.* National Park Service, Center for Colorado Plateau Studies, Northern AZ U., Flagstaff.

Canopy cover of upland perennial grasses was 61% on the Appleton-Whittell Research Ranch (AWRR) and 41% on adjacent cattle ranches. Peak fall densities of grasshoppers were three times higher on grazed lands. The bunch grass lizard was the most abundant reptile on AWRR and

virtually absent on adjacent ranches. Cottonrats, harvest mice, and hispid pocket mice were the most common rodents in ungrazed habitat, whereas deer mice and kangaroo rat predominated in grazed areas. Montezuma quail, Cassin's sparrows, Botteri's sparrows, and grasshopper sparrows were common breeding birds on AWRR, whereas scaled quail, horned larks, and lark sparrows were the most abundant nesting birds on grazed lands.

Bock, Carl E., Jane H. Bock, Hobart M. Smith. 1993. **Proposal for a System of Federal Livestock Exclosures on Public Rangelands in the Western United States.** Conservation Biology, Vol. 7, No, 3, September 1993. 731-733 pgs.

A program of large federal livestock exclosures, permanently protecting 20% of public rangelands from grazing, could re-impose on the west something like the environmental mosaic formerly maintained by natural ecological forces. It would provide refuge for indigenous flora and fauna now threatened by the domestic grazers and would establish an invaluable system of reference points from which to quantify the ecological consequencs of grazing. Implementation of the program also might make allies out of groups presently contending for control of American rangelands.

1992

*Babb, Geoffrey Dean. 1992. **Sprouting Response of Quercus arizonica And Quercus emoryi Following Fire**. M.A. Thesis with a Major in Watershed Management. School of Renewable Natural Resources, U. of AZ. Tucson. 76 pgs.

Following a natural fire, the sprouting response of the two oaks is similar with smaller stems of both species most likely to sprout and to have a greater number of sprouts per centimeter, suggesting that a tree possesses a static number of buds throughout its lifetime. Top-kill appears to have little effect on the number of sprouts produced.

*Bock, Carl E. and Jane H. Bock. 1992. **Effects of 22 Years' Livestock Exclusion in an Arizona Grassland.** Report to: Grazing Symposium, Flagstaff. Sponsored by National Park Service. 20 pgs.

Livestock function as a keystone species in grasslands of southeastern Arizona, because their activities can determine which components of the native flora and fauna persist or increase, and which decline or disappear.

*Bock, C.E., J.H.Bock. 1992. **Response of Birds to Wildfire in Native Versus Exotic Arizona Grassland.** Southwestern Naturalist 37: 73-81.

Grass and shrub cover decreased and herb cover increased for two years after a 1987 wildfire. Numbers of birds increased dramatically on burned plots for two years, probably in response to increased seed production and availability. Dominant species attracted to the burn were mourning dove, horned lark, vesper sparrow, and savannah sparrow. Species attracted to the burned site for 2-3 years included mourning dove, horned lark, and lark sparrow. Species avoiding burned plots were grasshopper sparrow, Botteri's sparrow, Cassin's sparrow, and eastern meadowlark. There was no evidence that burning facilitated permanent return of native species to depauperate plantations of exotic grasses. Fire may have rendered exotic grasslands more suitable to certain summer birds by reducing otherwise heavy accumulations of litter.

*Bock, C.E., J.H. Bock, M.C. Grant. 1992. **Effects of Bird Predation on Grasshopper Densities in an Arizona Grassland.** Ecology 73: 1706-1717.

Birds clearly limited grasshopper abundance in grasslands but this had no appreciable impact on vegetative cover or species composition.

*Bock, C.E., A.Cruz, Jr., M.C. Grant, C.S. Aid, T.R. Strong. 1992. **Field Experimental Evidence for Diffuse Competition among Southwestern Riparian Birds.** American Naturalist 140: 815-828.

Open-nesting bird species decreased in abundance and cavity-nesting species increased after nest-boxes were added in 50 experimental areas, as compared to an equal number of control areas. This indicated community wide (diffuse) competition is an important factor influencing distribution and abundance of birds in riparian ecosystems.

*Bock, J.H., C.E.Bock 1992. **Short-term Reductions in Plant Densities following Prescribed Fire in an Ungrazed Semidesert Shrub-grassland.** Southwestern Naturalist 37: 49-53.

Grass and herb densities were reduced for one and two years followng a prescribed fire in June, following 15 years of no fire or grazing but no irreversible changes in vegetation appeared.

*Bock, J.H., C.E.Bock. 1992. **Vegetation Responses to Wildfire in Native vs Exotic Arizona Grassland.** J. Vegetation Science 3:439-446.

Native and exotic grasses appeared equally tolerant of a mid-July wildfire, probably because both evolved in fire-type ecosystems. There was no evidence that fire can be used to permanently restore the diverse native flora to species-poor plantations dominated by two South African exotic lovegrasses (*Eragrostis lehmanniana* and *E.curvula*).

*Braker, E. 1992. **Feeding Behavior of *Melanoplus gladstoni:* a Flexible Generalist Grasshopper.** Report to Research Fellow Program, Appleton-Whittell Research Sanctuary. 3 pgs. Unpubl.

The grasshopper, *Melanoplus desultoris,* has strong, fixed preferences for the shrub, *Haploppaus tenuisectus,* while the *Melaanoplus gladstoni* grasshopper is flexible in its feeding behavior.

*Thomas, P.A., P. Goodson. 1992. **Conservation of Succulents in Desert Grasslands Managed by Fire.** Biological Conservation 60: 91-100.

Long term conservation of succulents is dependent on the fire regime imposed. The majority of plants stayed alive after being burned, but fewer plants survived more intense or repeated fires.

*Valone, Thomas J. 1992. **Information for Patch Assessment: a Field Investigation with Black-chinned Hummingbirds.** Behavioral Ecology 3(3): 211-222.

Hummingbirds apparently combine prior information on the distribution of resources within patches with current patch sampling to increase foraging efficiency. Individuals using prior information foraged more efficiently than those that did not.

1991

*Bock, Carl E. and Jane H. Bock. 1991. **Response of Grasshoppers (Orthopters: Acrididaae) to Wildfire in a Southeastern Arizona Grassland.** American Midland Naturalist 125: 162-167.

Combined adult and nymph grasshopper densities declined over 60% on burned plots relative to unburned plots on the first postfire year, but these differences disappeared by the second year. Some species known to prefer habitats with much bare ground and/or herbaceous foods temporarily increased following the fire. However, most species declined temporarily, probably as a result of direct fire-caused mortality and fire-induced reductions in grass cover.

Brunswig, N., K. Lake. 1991. **Appleton-Whittell Research Sanctuary: Impacts of Livestock Grazing. P. 22-23 *in* (Tensie Whelan, editor) *Wildlife Sanctuaries..* National Audubon Society Sanctuary Department. Sharon, CT.

This article outlines the research objectives, projects and capabilities of the Appleton-Whittell Research Sanctuary of the National Audubon Society.

+Cross, A.F. 1991. **Vegetation of Two Southeastern Arizona Desert Marshes.** Madrono 38:185-194.

Species distributions were best correlated with environmental factors related to the moisture regime and to the amount of canopy cover and least correlated with disturbance and bare ground.

*Lima, S.L., T.J.Valone. 1991. **Predators and Avian Community Organization: an Experiment in a Semi-desert Grassland.** Oecologia 86:105-112.

As cover increases, species with *cover-dependent* escape tactics also increase, while *cover-independent* species decrease greatly. Some cover-independent species may actively avoid cover-rich areas.

*Ortega, J.C. 1991. **The Annual Cycle of Activity and Weight of Rock Squirrels (*Spermophilus variegatus*) in Southeastern Arizona.** American Midland Naturalist 126:159-171.

Adult rock squirrels are relatively inactive from late Oct. through Feb.; juveniles appear above ground in July and continue being active throughout the fall. Annual activity and weight gain patterns were the same for juvenile males and females. In fall, adult males are significantly less

active (and emerged earlier) than females Only in late May and early June (middle of mating season) are adult males significantly heavier than females.

*Thomas, P.A., P. Goodson. 1991. **Long Term Effects of Fire on Cacti.** Report on field research conducted at the Appleton-Whittell Research Ranch Sanctuary and the Buenos Aires National Wildlife Refuge. 2 pgs. Unpubl.

Eighty percent of the small cacti, *Coryphantha vivipara, Echinocereus pectinatus, Neolloydia intertexta,* (40% more than the control group) were dead four years after a fire; *Mammillaria gummifera,* however, had 20% dead compared to 70% mortality in control plants. There was a long term mortality of about 70% for the large cactus, *Ferocactus wislizenii.*

*Valone, T.J. 1991. **Bayesian and Prescient Assessment: Foraging with Pre-harvest Information.** Animal Behaviour 41:569-577.

Inca doves feeding in artificial resource patches exploited patches in a manner consistent with prescient foraging when patch quality was temporally predictable. The same individuals exploited patches in a manner consistent with Bayesian foraging when prescient foraging would not be likely because patch quality was temporally unpredictable.

1990

+Aid, C.S. 1990. **Changes in Breeding Bird Density after Prescribed Burning in an Arizona Semidesert Grassland.** M.A. Thesis, U. of CO, Boulder. 44 pgs.

Perennial grass cover in the Fort Huachuca area was reduced through two post-fire years, shrub density for one year with no long-term changes. Five of 20 common bird species became more abundant, five became less abundant.

*Bock, C.E., J.H.Bock. 1990. **Effects of Fire on Wildlife in Southwestern Lowland Habitats.** Pp.50-64 *in* (J.S.Krammes, tech.coord.) *Effects of Fire in Management of Southwestern Natural Resources.* USDA Forest Service Gen.Tech.Report RM-191. Rocky Mt.Forest and Range Experiment Station, Fort Collins.

Prescribed burning can benefit most wildlife in semidesert grasslands, especially if used to create fine-scale mosaics of native vegetation, including some unburned stands. Fire is likely to negatively affect vegetation and wildlife in Sonoran desert scrub, Chihuahuan Desert grassland, and riparian woodland.

*Bock, Carl E. , Hobart M. Smith, Jane H. Bock. 1990. **The Effect of Livestock Grazing upon Abundance of the Lizard, *sceloporus scalaris,* in Southeastern Arizona.** J. of Herpetology, Vol. 24, No. 4, 445-446 pgs.

Although previously thought to live mostly in isolated montane meadows, the bunchgrass lizard (*sceloporus scalaris)* was found to be abundant in a lowland semidesert grassland that has been protected from livestock grazing for over 20 years. The magnitude of difference between grazed and ungrazed grassland in abundance of the lizards was over ten times in favor of the ungrazed land. Any lizards found in the grazed land was near bunchgrass or other safe cover. So it would seem that the primary role of bunchgrass as a vital habitat requirement is in providing protection from predators.

*Koenig, W.D., P.B. Stacey. 1990. **Acorn Woodpeckers: Group Living and Food Storage under Contrasting Ecological Conditions.** P. 415-453 *in* (P.B.Stacey and W.D.Koenig, eds.) *Cooperative Breeding in Birds*. Cambridge University Press, Cambridge.

Individual colonies of acorn woodpeckers may have chosen group living and mate sharing for different reasons, including environmental constraints to dispersal (all territories occupied) as well as benefits to remaining in a high-quality territory.

*Ortega, J.C. 1990. **Home-range Size of Adult Rock Squirrels (*Spermophilus variegatus*) in Southeastern Arizona.** J. Mammalogy 71:171-176.

Ranges of adult males were largest during the breeding season (May-June) and generally decreased in size during the remainder of the year. Also, there was considerable intra- and intersexual overlap of home ranges.

*Ortega, J.C. 1990. **Reproductive Biology of the Rock Squirrel (*Spermophilus variegatus*) in Southeastern Arizona.** J. Mammalogy 71:448-457.

The mating period lasted approximately nine weeks, and the timing of the mating was associated closely with heavy summer rains, as juveniles first emerged shortly after the beginning of the rains and the concomitant increase in production of vegetation.

*Plume, C.A. 1990. **Vegetative Propagation of Arizona Sycamore (*Platanus wrightii)* by Cuttings.** M. S. Thesis, School of Renewable Natural Resources. U. of AZ. 64 pgs.

Propagation of young, basal cuttings of greater than 1 cm diameter is possible in a greenhouse when treated with no or 5,000 ppm IBA and planted in a soil medium that allows for sufficient drainage. However, they cannot survive periods of drought and should not be transplanted until a well-developed root system is established. While cuttings in all studies successfully rooted in the greenhouse, no plants survived outplanting on a 160 m elevation floodplain.

*Smith, H.M., C.E. Bock. 1990. **Unicolor Hatchling Coloration in a Population of the Lizard *Sceloporus undulatus consobrinus* in Southeastern Arizona.** Bulletin of the Maryland Herpetological Society 26:14-16.

Upon hatching, *sceloporus undulatus consobrinus* are totally gray-brown in color. The *S. undulatus* is the only subspecies known to have newly-hatched unicolor juveniles. Within two months, the normal stripes and spots are clearly defined.

*Smith, H.M., C.E. Bock, J.H. Bock. 1990. **Notes on Reproduction and Coloration of the Bunch-grass Lizard, *Sceloporus scalaris,* in Southeastern Arizona.** Bulletin of the Maryland Herpetological Society 26:64-67.

No unicolor individuals were seen among 100 bunch-grass lizards during summer and fall of 1989. Reproduction occured later than at higher altitudes and hatchlings were unusually large. Males had enlarged postanal scales.

*Stromberg, M.R. 1990. **Habitat, Movements, and Roost Characteristics of Montezuma Quail in Southeastern Arizona.** Condor 92:229-236.

Pairs were observed from April/May through September. Coveys of up to 6-8 birds declined in numbers from September through April. Coveys used small areas [0.09-6 ha (0.2-13 acres)]. During midwinter, the same small area would be used for long periods. In late winter and early spring, coveys occupied much larger areas by sequentially spending 3-10 days on adjacent, nonoverlapping areas as large as 50 ha (110 acres). Quail preferred southeast-facing hillsides in tall grasses for night roosts. Day-use areas were selectively on north-facing hillsides. Areas used by quail during the day were generally on hillsides, about 16 m (50 ft) from the nearest oak tree and had grass cover intermediate between barren areas under oak trees and more dense grass farther away from the oaks.

*Stromberg, M.R., P.B. Johnsen. 1990. **Hummingbird Sweetness Preferences: Taste or Viscosity?** Condor 92:606-612.

Black-chinned Hummingbirds responded to decreased sucrose concentrations by increasing sampling behavior at feeders; at increased sucrose levels, sampling behavior decreased. Chemosensory mechanisms rather than physical measures of viscosity are responsible for the sensory evaluation and the subsequent selection of sucrose nectars.

*Strong, T.R., C. E.Bock. 1990. **Bird Species Distribution Patterns in Riparian Habitats in Southeastern Arizona.** Condor 92:866-885.

Cottonwood habitats had the greatest bird species richness, and both cottonwood and sycamore habitats had high total bird density during the breeding season. Upland vegetation was more important in winter, and plots in open grassland areas had greater richness and density. Widespread, abundant species in the Huachuca Mountains were also widespread and abundant in the western U.S.

*Valone, T.J. 1990. **Information and Exploitation: Patch Assessment Strategies in Birds and Mammals.** Ph.D. Thesis, Department of Environmental, Population and Organismic Biology. U. of AZ. Tucson.170 pgs.

Individual foragers exploit resource patches by 1) sampling a patch 2) using prior experience 3) combination of both (called Bayesian foragers). Group foragers also use: 4) observation of foraging

success of other group members (Public information). Use of Public information allows groups to estimate patch quality faster than solitary foragers and may prevent the underutilization of patches.

*Webb, E.A., C.E. Bock. 1990. **Relationship of the Botteri's Sparrow to Sacaton Grassland in Southeastern Arizona.** Pp.199-209 *in* (P.R.Krausman, and N.S.Smith, eds.) *Managing Wildlife in the Southwest.* Arizona Chapter of the Wildlife Society, Phoenix, AZ.

Sacaton, a tall floodplain grassland species, has declined historically in Arizona, along with the Botteri's sparrow. The best predictors of sparrow abundance were sacaton height, sacaton density, area of grass clump overhang, and percent senescent growth. The Botteri's sparrow is a tallgrass specialist that may not reach maximum breeding densities until 20 years or more after a burn or other habitat disturbance.

1989

*Bock, J.H., C.E. Bock. 1989. **Factors Limiting Sexual Reproduction in *Plantanus wrightii* in Southeastern Arizona.** Aliso 12:295-301.

Reproductive failure of Arizona's sycamore in certain canyons cannot be explained either by activities of domestic animals or by lack of viable seeds. Flash flooding events in some canyons washed out the seedlings and saplings present, but left viable larger trees. A permanent, high water table was essential to seedling survival.

*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.

Long-term response to release from grazing included both increases in types of grasses and significant increases in canopy cover for midgrass, shortgrass, shrub, and forb plant groups. Total vegetation cover was not significantly different on the grazed and ungrazed areas, but cover of midgrasses was significantly different (this difference due to increased cover of plains lovegrass on ungrazed pasture. Data do not support the hypothesis that continued animal impact is necessary to prevent ecosystem deterioration.

*Delesalle, V. 1989. **Year-to-year Changes in Phenotypic Gender in a Monoecious Cucurbit, *Apodantyhera undulata.*** American J. Botany 76:30-39.

Small plants produce no flowers. Larger plants produce only male flowers; a larger size is needed for production of cosexual flowers. Approximately 85% of the plants that bloomed did not change gender group between years. Beyond the threshold size for cosexual flower production, plant size was not correlated with femaleness. Patterns suggest all plants are male until they reach a certain size.

*Elias, T,S., J.H. Bock, O. Dorado, A. Liston, K. Tomlinson, J.L. Villasenor. 1989. **Checklist of the Vascular Plants of The Research Ranch, Elgin, AZ.** The Research Ranch Sanctuary. 13 pgs. Unpub.

A systematic list of species and areas where they are found on the Appleton-Whittell Research Ranch is outlined.

*Holmes, R.D, K. Jepson-Innes. 1989. **A Neighborhood Analysis of Herbivory in *Bouteloua gracilis.*** Ecology 70: 971-976.

This study examined whether an individual plant's risk of herbivory was affected by its nearest neighbor. Small-scale spatial pattern within a community is an important determinant of herbivory.

*Jepson-Innes, K., C.E. Bock, 1989. **Response of Grasshoppers (Orthoptera: Acrididae) to Livestock Grazing in Southeastern Arizona: Differences Between Seasons and Subfamilies.** Oecologia 78:430-431.

Grasshopper densities were 3.8 times greater on ungrazed than grazed semidesert grassland sites in southeastern Arizona. Grama (*Bouteloua*) dominated perennial grass cover was about 1.5 times greater on the ungrazed. Grasshopper use of areas also correlated with grasshopper species and season.

*Maurer, B.A., E.A. Webb, R.K. Bowers. 1989. **Nest Characteristics and Nestling Development of Cassin's and Botteri's Sparrows in Southeastern Arizona.** Condor 91:736-738.

The closely related Cassin's Sparrow (*Aimophila cassinii)* and Botteri's sparrow (*Aimophila. botterii)* breed in similar habitats in southeastern Arizona. The Bottteri's sparrow nests on the ground (May-August) while the slightly smaller Cassin's Sparrow nests in shrubs (July-August) . These differing habitat use characteristics occurred when the species were geographically separated prior to the current coevolutionary adjustment of the species to one another.

1988

*Bock, C. E. and J.H. Bock. 1988. **Grassland Birds in Southeastern Arizona: Impacts of Fire, Grazing, and Alien Vegetation.** *In* (P. Goriop, ed.) *Ecology and Conservation of Grassland Birds*. Tech. Publ. No. 7, International Council for Bird Preservation, Cambridge, England.

Twenty-five bird species are common in the grasslands of southeastern Arizona. Burning temporarily increases herb growth and seed production, especially in Sacaton grassland. Doves, quail, and sparrows respond positively to these changes. Lovegrasses (*Eragrostis* spp.) that are native to Africa, have been planted in Arizona in an attempt to revegetate degraded rangelands. Compared to ungrazed native grasslands on the Appleton-Whittell Research Ranch (AWRR), these plantations are ornithologically sterile, probably because they produce fewer seeds and insects. Dominant birds on the AWRR are grassland specialists, while the common species on adjacent grazed lands are those typical of relatively open and xeric habitats. Cassin's Sparrow (*Aimophila cassinii*) and the Grasshopper Sparrow (*Ammodramus savannarum)* are the most abundant upland breeding birds on the AWRR: they are uncommon on heavily grazed pastures. The Botteri's Sparrow (*Aimophila botteri)* is a sacaton specialist, abundant on the AWRR but missing where this habitat has deteriorated.

*Ortega, J.C. 1988. **Activity Patterns of Different-aged Coyotes (*Canis latrans*) Pups in Southeastern Arizona.** J. Mammalogy 69:831-835.

Litters of 4-5 coyotes are born May-June and become more active at increasing distances from their den until approximately 8-10 weeks of age; thereafter, they may start to follow adults during daily activities. Larger pups generally were more active than small pups with respect to the distance from their own den that they were observed, the behaviors in which they engaged, and in the proportion of time they were visible outside of their dens. Play in these coyote pups was similar to that reported for captive animals. Larger pups played more than smaller pups. The age at which larger pups were first observed coincided closely with the peak of play soliciting observed in pairs of captive coyote pups.

*Ortega, J.C. 1988. **The Behavioral Ecology and Natural History of the Rock Squirrel in Southeastern Arizona.** Ph.D. Thesis, Department of Environmental, Population and Organismic Biology. U. of CO, Boulder. 216 pgs.

Rock squirrel den sites were most common in oak savanna and riparian areas relative to the availability of habitat. Mating occurred from mid-April to early July. Sexual dimorphism (differences) in weight develops in later years of life; adult males are generally heavier than females. Adults were inactive above ground from late October to February. Rock squirrels were neither intra- nor intersexually territorial.

*O'Shea-Stone, M. 1988. **The Seed Bank in a Semidesert Grassland of Southeastern Arizona, and its Relationship to Seed Rain and Vegetation.** M.A. Thesis, Department of Environmental, Population, and Organismic Biology. U. of CO, Boulder. 71 pgs.

The density of perennial grass seeds in the seed bank fell within the range of previously reported values from other grasslands.

1987

*Blanchard, C.L., M.R. Stromberg. 1987. **Acidic Precipitation in Southeastern Arizona: Sulfate, Nitrate, and Trace-metal Deposition.** Atmospheric Environment 21:2375-2381.

Precipitation was collected during 1984 and 1985 at two sites in southeastern Arizona within 100 km of two copper smelters. High acidity and sulfate concentrations occurred when upper-level winds were from the directions of the smelters. Methods to evaluate the smelter contribution to precipitation sulfate on an annually-averaged basis were not applicable to individual precipitation events.

+Bock, C.E. 1987. **Distribution-abundance Relationships of Some Arizona Landbirds: a Matter of Scale?** Ecology 68:124-129

The same species that were most abundant locally in the Huachuca Mts. of southeastern Arizona were also most abundant on Christmas bird counts across Arizona and throughout the western United States. The positive correlation between distribution and abundance of winter landbirds appears to be an intrinsic property of the species themselves.

*Bowers, R.K., Jr., J.B.Dunning, Jr. 1987. **Nutting's Flycatcher (*Myiarchus nuttingi*) from Arizona.** American Birds 41:5-10.

Nutting's Flycatcher is a common inhabitant of thorn-shrub and open forest from central Sonora south along the west coast of Mexico and Central America as far as Honduras. Its closest breeding locality to the United States is near Ures, Sonora, 215 Kilometers from the Arizona border. The lack of U.S. records for this species may stem from the difficulty in distinguishing it in the field. The mouth lining is the most reliable feature for identification. All sightings of Nutting's Flycatcher in the United States must be carefully documented.

*Delesalle, V.A. 1987. **Patterns of Gender Allocation in a Monoecious Cucurbit, *Apodanthera undulata*, and their Reproductive Consequences.** Ph.D. Thesis, Department of Ecology and Evolutionary Biology. U.of AZ, Tucson. 123 pgs.

Plants initially produce only male flowers at reproductive maturity, Older and larger plants are capable of producing female flowers. Allocation to both male and female flowers was equally increased with size. The number of female flowers decreased when the number of total flowers increased. Plants that opened only male flowers one year were likely to open only male flowers the next year. Similarly, plants that opened both sexes of flowers repeated the trend the following year. The gains for male success were greater in high density populations than in low density populations.

+Fernald, A.S. 1987. **Plant Community Ecology of Two Desert Marshes in Southeastern Arizona: Babocomari Cienaga and Canelo Hills Cienaga.** M.A. Thesis, Department of Environmental, Population and Organismic Biology. U.of CO, Boulder. 126 pgs.

Data suggests the existence of vegetational zones within cienagas. Moister gradient is the underlying component to establishment of plant zones in cienagas. Canopy cover, stability, disturbance, water depth, and water flow are also important factors.

+Gawith, E.L. 1987. **Possible Causes of Alligator Juniper (*Juniperus deppeana*) Invasion in Southeastern Arizona.** M.A. Thesis, Department of Environmental, Population and Organismic Biology. U. CO, Boulder. 86 pgs.

The principal cause of the invasion of alligator juniper in southeastern Arizona is a reduction in grassland fires. Climatic change, greater seed dispersal, and reduced competition from grasses are believed to have played a minor role in the encroachment of alligator juniper. The reduction in grassland fires is a result of two factors: 1) purposeful fire suppression by humans; 2) lowering of natural fuel due to its consumption by domestic animals.

*Monovich, R.C. 1987. **Habitat Use by the Montezuma Quail on the National Audubon Society, Appleton-Whittell Research Ranch Sanctuary.** Paper for B.A. Kalamazoo College, MI**.** 26 pgs. Unpubl.

Quail, radio-tagged and followed Jan.-Mar., confirmed that this species is relatively sedentary, having small home territories, using south-facing hills for roosting and north-facing hills for foraging.

*Ortega, J.C. 1987. **Coyote Food Habits in Southeastern Arizona.** Southwestern Naturalist 32:152-155.

Rabbits and cotton rats were the most important foods of coyotes during all seasons on the Appleton-Whittell Research Ranch (in a study of the year-round and seasonal diets of coyotes living under relatively natural conditions). Of scats containing rabbits, 80% were desert cottontails and 20% were blacktailed jackrabbits. Rodents were present in greater numbers (in scats) during spring, summer, and fall 1982 but decreased in subsequent samples. The number of scats containing birds and reptiles did not vary significantly with season.

*Ortega, J.C. 1987. **Den Site Selection by the Rock Squirrels (*Spermophilus variegatus)* in Southeastern Arizona.** J.Mammalogy 68:792-798.

Rock squirrel den sites occurred in greater than expected frequencies, relative to habitat availability, in oak savanna and riparian habitats. In comparison to control sites, dens were located: on steeper slopes, in shadier spots, closer to oaks, and closer to washes; also: associated with prominent potential lookout points, in areas with less ground cover, and associated to a lesser degree with more northerly facing slopes.

*Pulliam, H.R., J.B. Dunning. 1987. **The Influence of Food Supply on Local Density and Diversity of Sparrows.** Ecology 68:1009-1014.

Sparrow population densities in this habitat are only limited during infrequent years of very low seed production.

*Strong, T.R. 1987. **Bird Communities in the Riparian Habitats of the Huachuca Mountains and Vicinity in Southeastern Arizona.** Ph.D. Thesis, Department of Environmental, Population, and Organismic Biology. U, of CO, Boulder. 419 pgs.

The type of dominant riparian tree species influenced bird species richness and total density during the breeding season. Cottonwood habitats had the greatest richness, and both cottonwood and sycamore habitats had high density. Upland vegetation was more important to species densities in the winter, and plots in open grassland areas had greater richness and density. The species which are widespread and abundant in the Huachuca Mountains are also widespread and abundant in the western United States.

*Strong, T. R. 1987. **Status report: Arizona Grasshopper Sparrow.** Report prepared for: AZ Game and Fish Department, Phoenix. Contract #:FC-67. 42 pgs.

The populations of the Arizona grasshopper sparrow may have decreased dramatically over the past four years and formerly suitable habitat may have been degraded by heavy grazing pressure and urban encroachment.

+Sutherland, S. 1987. **Why Hermaphroditic Plants Produce Many More Flowers than Fruits: Experimental Tests with *Agave mckelveyana*.** Evolution 41:750-759.

"Excess" flowers (flowers that fail to produce fruits) act as pollen donors and contribute to male fitness.

1986

*Bock, C.E., J.H. Bock, J.E. Jepson and J.C. Ortega. 1986. **Ecological Effects of Planting African Lovegrass in Arizona.** National Geographic Research 2:456-463.

The impact of planting African lovegrass (*Eragrostis lehmanniana* and*E. curvula)* to revegetate southwestern rangeland has been dramatic. In comparing this exotic grassland to native grasslands, the native grassland community included a significantly greater variety and abundance of indigenous grasses, herbs, shrubs, grasshoppers, rodents, and birds. Only three indigenous animal species were more common in areas dominated by African lovegrass. Twenty-six species (10 plants, 5 birds, 3 rodents, 8 grasshoppers) were more abundant in the native grasslands. It remains to be determined whether protected native grasslands can resist continued invasion by the African species.

+Bock, C.E., D.L. Larson. 1986. **Winter Habitats of Sapsuckers in Southeastern Arizona.** Condor 88:246-247.

Williamson's Sapsuckers (*Sphyrapicus thyroideus*) were less abundant and less widespread than Yellow-bellied Sapsuckers (*Sphyrapicus varius*) in the Huachuca Mts. during a winter survey in 1984 and 1985. Williamson's were confined largely to pine-oak and oak-juniper habitats, where they drilled for sap mostly in pines and junipers. Yellow-bellied drilled holes in nearly all types of trees. Both sexes of each species feed on Madrono berries. While the two species differed significantly in terms of habitats and feeding trees, these results do not indicate a complementary ecological relationship; Williamson's occupied a subset of habitat and trees used by the more abundant and widespread Yellow-bellied. Female Williamson's occurred at a significantly lower mean elevation and in different habitats and trees than males. It is not clear how this difference in habitat might be related to such dramatic plumage differences, nor is it clear why the sexes should choose different habitats in the first place. Males and females of Williamson's appeared more

camouflaged on their respective trees. There is evidence that female Williamson's may be more nomadic and opportunistic than males in winter. No such gender segregation was apparent in Yellow-bellied.

Bock, J.H., C.E. Bock. 1986. **The Appleton-Whittell Research Sanctuary of the National Audubon Society. Desert Plants 8:47-48.

The Appleton-Whittell Research Ranch was established in 1969 by Ariel and Frank Appleton and their four children. Its goal was to promote ecological research, conservation, and education. Domestic cattle were removed from the Ranch's 7,830 acres in 1967. In 1980, the National Audubon Society purchased the Ranch with a grant from the George Whittell Foundation disbursement. The Research Ranch Foundation returned the purchasing money to National Audubon Society which manages the sanctuary. Interest from the endowment is used to maintain the facility, but it does not support individual research projects.

*Bock, J.H., C.E. Bock. 1986. **Fire Effects Following Prescribed Burning in Two Desert Ecosystems.** Final Report (Cooperative Agreement No. 28-C3-278) to: Rocky Mountain Forest and Range Experiment Station U.S. Forest Service. July 9, 1986. 35 pgs.

Viewed as a whole, fires had only transitory effects on study sites, indicating fire is an important natural force in the grassland ecosystem. The finding that fires are not catastrophic, even during the height of the fire season in the high fuel loads of an area not utilized by domestic grazers, is significant.

*Bock, J.H., C.E. Bock. 1986. **Habitat Relationships of Some Native Perennial Grasses in Southeastern Arizona.** Desert Plants 8:3-14.

Blue Grama (*Bouteloua gracilis*) was the most widespread and abundant species overall. It reached highest densities on level lowlands, where it was dominant along with Sacaton (*Sporobolus wrightii*) and Vine Mesquite (*Panicum obtusum)*. Sideoats Grama *(B. curtipendula*) was the most abundant species on steep slopes above floodplains and washes. Level to gently rolling uplands were dominated by Blue Grama, Plains Lovegrass (*Eragrostis intermedia)*, and Wolftail (*Lycurus phleoides*). Steep and rocky uplands were covered by Threeawns (*Aristida spp.*), Curly Mesquite (*Hilaria belangeri)*, and Sprucetop Grama (*B. chondrosioides)*.

+Dunning, J.B., Jr. 1986. **Bander's Forum.** North American Bird Bnder, Vol. II, No. 2:59-60.

Letter suggests that NABB publish primary biological data collected by banders as a regular feature. Examples of the Botteri's sparrow, Cassin's sparrow and Yellow-eyed junco were included to illustrate the three measurements most important to ecologists studying relationships between sparrow species.

*Dunning, J.B., Jr., R.K. Bowers, Jr. 1986. **Weights and Measurements, No 1: Arizona Sparrows.** North American Bird Bander 11:59-60.

Tables of weights and measurements are presented. Data was collected form live birds captured in mist nets. Botteri's sparrow (*Aimophila botteri)* were banded from June to August 1981-84 on the Appleton-Whittell Research Ranch. Cassin's sparrow (*Aimophila cassinii)* were banded year-round from 1982-85 at the Ranch. The Yellow-eyed Junco (*Junco phaeonotons)* were banded year round from 1982-85 in the Santa Catalina Mts.

*Guervitch, J. 1986. **Competition and the Local Distribution of the Grass *Stipa neomexicana*.** Ecology 67: 46-57.

Within a grassland in southeastern Arizona, *Stipa neomexicana* occurs only on dry ridge crests with low total grass cover, while total grass cover is greater below the ridge crests in moister, low-lying areas. Increasing competition from neighboring grasses along the topographic gradient was responsible for restricting *Stipa neomexicana* to the unfavorable ridge crest sites.

*Kenney, W.R., J.H.Bock, C.E.Bock. 1986. **Responses of the Shrub, *Baccharis pteronioides,* to Livestock Exclosure in Southeastern Arizona.** American Midland Naturalist 116:429-431.

Protected populations of *Baccharis* were denser than those on the adjacent cattle ranches, and comparable to densities of the shrub found on nearby small livestock exclosures established in 1925 and 1949. This shrub is fire resistant. Thus, it is unlikely that semidesert grassland in this area will return to its earlier shrub-free state in the foreseeable future.

*Maurer, B.A. 1986. **Predicting Habitat Quality for Grassland Birds Using Density-habitat Correlations.** J.Wildlife Management 50:556-566.

The scale at which habitats are measured to develop regression models relating density to habitat features may be too coarse to account for significant variation among individual breeding pairs in a given habitat. Results of this study might raise questions regarding the use of qualitative models in monitoring and predicting the response of bird species to changes in their habitats. The implication of the study is that even quantitative models that make use of density data may not provide enough information to precisely evaluate and predict impacts on wildlife populations due to habitat alteration.

*Pulliam, H.R. 1986. **Niche Expansion and Contraction in a Variable Environment.** American Zoologist 26:71-79.

When food is abundant, sparrows are found in a great variety of habitats and appear to specialize on particularly profitable types of seeds. However, during periods of food scarcity, each sparrow species occupies a very narrow range of habitats but consumes a great variety of seeds within each occupied habitat.

*Stromberg, M.R., C.E. Bock, J.H. Bock. 1986. **Potential Role of the Research Ranch in the Masked Bobwhite Recovery Program.** Pp. 22-28 *in* (M.R. Stromberg, T. Johnson, S. Hoffman,eds.) *Masked Bobwhite Biology and Conservation: Proceedings of a symposium*. AZ Game and Fish Dept., Phoenix, and National Audubon Society. 45 pgs.

Only a small area on the Appleton-Whittell Research Ranch (AWRR)supports habitat that may be suitable for Masked Bobwhite. Release of Masked Bobwhite on the AWRR is not planned. If release does occur, it must be clearly stated as experimental and secondary to the primary recovery site.

*Stromberg, M.R., T.B. Johnson, S.H. Hoffman, Eds. 1986. *Masked Bobwhite Biology and Conservation. Proceedings of a Symposium.* AZ Game and Fish Department, National Audubon, U.S. Fish and Wildlife. 45 pgs.

Biologists who worked with the masked bobwhite over many years met to support the acquisition of the Buenes Aires National Wildlife Refuge and to discuss implementation of the recovery efforts.

1985

*Bailowitz, R.A. 1985. **Census of the Butterflies of the NAS Appleton-Whittell Research Ranch.** 20 pgs. Unpubl.

103 species of butterflies of the Appleton-Whittell Research Ranch were censused from August 1982 through January 1984. Original data are available.

Bock, C.E., J.H. Bock. 1985. **Ecological Effects of Planting Exotic Grasses in Southwestern Semidesert Ecosystems.** Preliminary report. January 31, 1985. National Geographic Society. Grant #2862-84. 10 pgs.

Twenty mammal species plus total numbers of breeding birds, winter birds and summer grasshoppers were significantly higher on the native grasslands while only 4 species plus total rodents were more common in stands of exotic African lovegrasses.

*Bock, J.H., C.E.Bock. 1985. **Patterns of Reproduction in Wright's Sycamore.** Pp. 493-494 *in* (R.R. Johnson et al., eds.) *Proceedings of the First North American Riparian Conference*. USDA Forest Service, Gen. Tech. Report RM-120. Rocky Mountain Forest and Range Experiment Station, Fort Collins.

In southeast Arizona, this tree produces large numbers of viable seeds that fall in a compact fruit shadow around parent individuals. Sexual reproduction usually fails due to drought or flash-flooding. Large numbers of seedlings and saplings grew in one site with permanent water and little flooding. Young trees grew in clumps, and always in the stream channel.

*Jepson, K. A. 1985. **Response of Grasshoppers to Changes in Vegetation Structure and Availability: A Comparison of Grazed and Ungrazed Sites in Southeastern Arizona.** M.A. Thesis, Department of Environmental, Population and Organismic Biology. U. of CO. 54 pgs.

Conclusions were 1) livestock grazing altered grasshopper species composition and abundance, 2) semidesert grasslands may differ from many Great Plains areas in that grasshoppers responded differently to grazing in the summer than during the fall, 3) grasshopper densities were higher on the ungrazed preserve during the summer but were lower in the fall than the grazed area, 4) changes in the total amount of bare ground, overall grass abundance and availability of certain preferred forbs were the most important factors in determining distribution and abundance of dominant grasshopper species.

*Maurer, B.A. 1985. **Avian Community Dynamics in Desert Grasslands: Observational Scale and Hierarchical Structure.** Ecological Monographs 55:296-312.

Peak bird densities and biomass in Mesquite savannah communities occurred during May-June. Grassland communities achieved highest bird densities and biomass during July-August. This fluctuation corresponds to the nutritional value of forage being produced which in turn affects the insect population upon which the avian community relies.

*Pulliam, H.R., 1985. **Foraging Efficiency, Resource Partitioning, and the Coexistence of Sparrows.** Ecology 66:1829-1836.

Large species of sparrows were more efficient than small species at handling large seeds. Large and small sparrow species were about equally efficient at handling small seeds. Different species of sparrows are likely to have broadly overlapping diets whenever seeds are scarce enough for the consumption of seeds by one species to have much impact on the availability of seeds to another species.

*Webb, E.A. 1985. **Distribution, Habitat, and Breeding Biology of the Botteri's Sparrow.** M.A. Thesis. Department of Environmental, Population and Organismic Biology. U. of CO, Boulder. 62 pgs.

Botteri's sparrows (*Aimophila botterii arizonae)* are tall-grass specialists that breed in small isolated colonies in several types of semidesert grassland and oak woodland in southeastern Arizona. They are most common in relatively undisturbed sacaton grassland. They nest following the commencement of summer rains (July). This is in response to a bloom in grasshoppers, their primary summer food source. The breeding cycle is short with high nestling mortality. Botteri's sparrows were not seen Arizona between 1893 and 1932. Their populations today are stable. These sparrows are present in sacaton bottoms but only those which border grassy hillsides, where they must forage for grasshoppers.

1984

*Bock, C.E., J.H. Bock. 1984 . **The Importance of Sycamores to Riparian Birds in Southeastern Arizona.** J.Field Ornithology 55:97-103.

Among the mid-elevation riparian trees, sycamores are of potential value to birds because of their large size and substantial dead wood. They also appear to be one of the most threatened tree species. There were only three sycamore saplings and no seedlings on the entire Appleton-Whittell Research Ranch at the time of this study despite the fact that the area has been protected from livestock grazing since 1968.

*Bock, C.E., J.H. Bock, W.R. Kenney, V.M. Hawthorne. 1984. **Responses of Birds, Rodents, and Vegetation to Livestock Exclosure in a Semidesert Grassland Site.** J.Range Management 37:239-242.

In 1981-82, a protected upland site supported 45% more grass cover, a comparatively mixed group of grass species, and 4 times as many shrubs as an adjacent grazed site. The grazed area supported a significantly higher number of birds in summer, while numbers did not differ in winter. Rodents were significantly more abundant inside the protected area.

*Bock, C.E., B. Webb. 1984. **Birds as Grazing Indicator Species in Southeastern Arizona.** J.Wildlife Management 48:1045-1049.

Cassin's sparrows can be excellent indicators of lightly grazed or protected range, but only where shrubs or small trees are present. Grasshopper sparrows were the best indicators of ungrazed rangeland with few shrubs or mesquite.

*Ferguson, C.W. 1984. **Dendrochronology on and Adjoining the Appleton-Whittell Research Ranch.** Progress report to: The Research Ranch Foundation. May 8, 1984. 20 pgs.

A dating control chronology based upon cores and cross section of Mexican Pinyon has been established back to A.D.1520. A ring count on a single specimen carries the chronology back to 1348.

*Freeman, C.E., W.H. Reid, J.E. Becvar, R. Scogin. 1984. **Similarity and Apparent Convergence in the Nectar-sugar Composition of Some Hummingbird-pollinated Flowers.** Botanical Gazette 145:132-135.

The data, primarily from southwestern North America, define a range of nectar composition, possibly representing the preferences of hummingbirds. The data support assertions of adaptive convergence in the sugar composition of nectar in hummingbird-pollinated species.

*Maurer, B.A. 1984. **Environmental Heterogeneity and Avian Community Structure in Southeastern Arizona Semidesert Shrub-grasslands.** Ph.D. Thesis, School of Renewable Natural Resources. U. of AZ, Tucson. 125 pgs.

Mesquite habitats appeared to have higher total (avian) densities than grasslands in 1982 and 1983 for the period April-June. In July and August, densities appeared to be higher in the grassland habitats.

*Strahan, J. 1984. **The Distribution of Riparian Vegetation of the Research Ranch, Elgin, Arizona.** Progress report on 1984 research. Unpubl.

No widespread damage to mature trees occured because of the long, dry period followed by flooding in 1983-1984 but no seedlings of sycamore, cottonwood or Gooding's willow were found on any of the four drainages. Streamflow/channel geomorphology has also influenced riparian vegetation and reproduction over the years.

1983

* **Ferguson, C. W. 1983. **Dendrochronology On and Adjoining the Appleton-Whittell Research Ranch.** Report on 1982 fellowship. 20 pgs. Unpubl.

It is possible to build a chronology using full cross sections of pinyon trees above 7,000 feet; use that as a control to date low elevation pinyon sections; then, use those to date the low elevation cores.

*Kenney, W.R. 1983. **Patterns of Post-grazing Succession in the Semi-desert Grassland of Southeastern Arizona, with Respect to B*accharis pteroonides.*** M.A. Thesis, Department of Environmental, Population and Organismic Biology. U. of CO, Boulder. 38 pgs.

Results of a comparison between grazed and ungrazed areas suggest the protected populations of *Baccharis pteroonides* are stable and will not decrease in the near future regardless of grazing by domestic livestock.

Leydet, F.G. 1983. **A Place of Subtle Beauty. Audubon: Nov. 1983: 72-81.

A description of the Appleton-Whittell Research Ranch and its objectives includes the beginning history of a place devoted to research, conservation and education and its eventual transfer to the National Audubon Society and endowment by the Whittell Foundation.

*Pulliam, H.R. 1983. **Ecological Community Theory and the Coexistence of Sparrows.** Ecology 64:45-52.

Ecological community theory attempts to predict the number and relative abundance of coexisting species of consumers based on resource utilization and availability. The observed patterns of species coexistence appear consistent with the Ecological Community Model based on resource abundance and aggressive interference. However, they are also consistent with coexistence based on interspecific partitioning of seeds by size.

1982

+Gurevitch, J. 1982. **C3 and C4 Photosynthesis, Competition, and the Limits to Grass Species Distribution in an Arizona Grassland.** Ph.D. Thesis, Department of Ecology and Evolutionary Biology. U. of AZ, Tucson. 89 pgs.

The only C3 grass found was restricted to dry exposed ridge crests within the hottest and driest part of the region. Increasing competition from C4 grasses along the topographic gradient was responsible for restricting *Stipa neomexicana* to the unfavorable ridge-crest sites.

+Kluth, W.R. 1982. **The Geology and Mid-mesozoic Tectonics of the Canelo Hills, Santa Cruz County, Arizona.** PhD. Thesis, Department of Geosciences, U. of AZ. Tucson. 245 pgs.

A Triassic (?) to late Jurassic continental volcanic arc was deposited on Paleozoic marine shelf rocks. A coarse clastic sequence that reflects continental rifting was deposited in the late Jurassic to Early Cretaceous over the arc terrane. Shallow seas transgressed the area in Late Early Cretaceous. Laramide compression affected the area in Late Cretaceous.

*Lane, Meredith A. and Donald W. Longstreth. 1982. **Evaluation of the Research Ranch, Inc. Santa Cruz County, Arizona as a potential National Natural Landmark.** Unpublished report for Division of Natural Landmarks, National Park Service, USDI. 32 pgs.

Because the area of Sacaton Grassland within the Appleton-Whittell Research Ranch meets so many of the criteria for National Natural Landmarks and is definitely of national significance, the evaluators recommended that it be so designated.

*Sutherland, S. 1982. **The Pollination Biology of Paniculate Agaves: Documenting the Importance of Male Fitness in Plants.** Ph.D. Thesis, Department of Ecology and Evolutionary Biology, U. of AZ. Tucson. 53 pgs.

Tests indicated: 1) there was no correlation between fruit set and stalk length, 2) pollinator availability was not important in determining fruit set, 3) percent fruit set is energy limited. More testing indicated "excess flowers" do not contribute to fruit production (female fitness); flowers are set primarily as pollen donors and contribute only to male fitness. Although male fitness is hard to quantify, evidence supports the importance of male fitness in hermaphroditic plants.

1981

*Appleton, A. 1981. **Endangered Species and the Research Ranch: the Case of the Bolson Tortoise.** P. 72-74 *in* (Carl E. Bock and Jane H. Bock, editors) *Proceedings of a Symposium on Southwestern Grasslands: Past, Present and Future*. March 2-4, 1981. Appleton-Whittell Research Ranch, Elgin, AZ. 119 pgs.

An intensive 9 year study indicates it is possible for the endangered Bolson tortoises to live and reproduce in a restricted area.

*Barstad, J.F. 1981. **Factors Controlling Plant Distribution in a Riparian Deciduous Forest in Southeastern Arizona.** M.A. Thesis, Department of Botany and Microbiology, AZ State U. Tempe. 178 pgs.

A riparian ecosystem is a dynamic, flexible unit dependent on the geology, topography and hydrology of the microhabitat and adjusting to moderate, slow perturbations.

*Bock, C.E., J.H. Bock, editors. 1981. *Proceedings of a Symposium on Southwestern Grasslands: Past, Present and Future.* Sponsored by BLM, U.S. Dep't of Interior and National Audubon Society. Appleton-Whittell Research Ranch, Elgin, AZ. 119 pgs.

Symposium provided eight recommendations to develop a long-term research program for the Appleton-Whittell Research Ranch, designed to efficiently generate information for the greatest possible value to managers of southwestern rangelands.

*Laven, R.D., P.N. Omi. 1981. **Fire Ecology and Prescription Fire Research Needs, Appleton-Whittell Research Ranch.** P. 24-32 *in* (Carl E. Bock and Jane H. Bock, editors) *Proceedings of a Symposium on Southwestern Grasslands: Past, Present and Future*. March 2-4, 1981. Appleton-Whittell Research Ranch, Elgin, AZ. 119 pgs.

Previous fire ecology studies in this region are highlighted and specific research objectives are presented for the Appleton-Whittell Research Ranch.

*Lindquist, K. 1981. **Observations on the Activity of Captive Bolson Tortoises (*Gopherus flavomarginatus*).** 21 pgs. Unpubl.

Details of captive Bolson tortoises' daily lives were intensively observed and reported over a three month period and compared to known facts of other tortoise species.

*McCarthy, M.M. 1981. **The Past and Future of Southwest Grasslands: Changing Issues in Land Planning: Communication, Information and Monitoring Strategies.** P. 99-113 *in* (Carl E. Bock and Jane H. Bock, editors) *Proceedings of a symposium on southwestern grasslands: past, present and future.* March 2-4, 1981. Appleton-Whittell Research Ranch. Elgin, AZ. 119 pgs.

Development of long term resource monitoring and the utilization of advanced information and communication technologies are necessary steps to the present and future management of southwestern grasslands.

*Omi, P.N. and R.D. Laven. 1981. **Fire Management by Prescription: An Approach for Integrating Fire and Land Uses at the Appleton-Whittell Research Ranch.** P. 17-23 *in* (Carl E. Bock and Jane H. Bock, editors) *Proceedings of a Symposium on Southwestern Grasslands: Past, Present and Future.* March 2-4, 1981. Appleton-Whittell Research Ranch, Elgin, AZ. 119 pgs.

The Appleton-Whittell Research Ranch provides an opportunity for the experimentation that should precede development of optimal fire management practices for southwestern grasslands. Specific objectives for the ranch should include: 1) baseline inventory of resources, 2) test burns in various habitat types, 3) possible remote sensing of fire behavior, 4) ultimate implementation of a fire management scheme, including prescription burning, in each of the major habitat types.

*Pulliam, H.R. 1981. **Seasonality in a Desert Grassland: Basic Research and Implications for Management.** P. 87-96 *in* (Carl E. Bock and Jane H. Bock, editors) *Proceedings of a Symposium on Southwestern Grasslands: Past, Present and Future.* March 2-4, 1981. Appleton-Whittell Research Ranch. Elgin, AZ. 119 pgs.

Annual cycles of precipitation and temperature, and the between-year variability in precipitation together result in great fluctuations in plant primary productivity that in turn, affects the population stability of all animal species in this ecosystem.

*Sanchini, P.J. 1981. **Population Structure and Fecundity Patterns in *Quercus emoryi* and *Quercus arizonica* in Southeastern Arizona.** Ph.D. Thesis, U. of CO., Boulder. 140 pgs.

Quercus arizonica populations show an older average age and more even distribution of individuals over the range of ages than *Q. emoryi.* 50% of the variation in acorn production of both is explained by trunk diameter and crown area differences. In *Q. arizonica,* fecundity increases beyond 160 years but decreases for *Q. emoryi.*

1980

*Pulliam, H.R. 1980. **Do Chipping Sparrows Forage Optimally?** Ardea 68:75-82.

Natural foraging theory is based on the premise that natural selection maximizes Darwinian fitness. Study results support the hypothesis that Chipping Sparrows approach but do not achieve a maximum rate of energy intake while foraging.

1979

*Bock,C.E., J.H.Bock. 1979. **Relationship of the Collared Peccary to Sacaton Grassland.** J.Wildlife Management 43:813-816.

Peccaries (*Dicotyles tajacu*) in the southwest use heavy cover for resting and sleeping during cold winter nights and hot summer days. Peccaries appeared to use sacaton bottomlands year-round as cover for sleeping and resting.

*Nathan, G.B. 1979. **Behavior and Ecology of *Gopherus flavomarginatus* in an Experimental Enclosure.** M.S. Thesis. Department of Ecology and Evolutionary Biology. U. of AZ. Tucson. 72 pgs.

A captive population of Bolson tortoises was observed in the daylight hours for 46 days and their activities recorded. Most active in the mornings, they foraged mostly on two common species of grasses, kept mostly near their own burrows, completed copulation near their burrows, but mostly remained solitary in their habits.

*Pulliam, H.R., T.A. Parker. 1979. **Population Regulation of Sparrows.** Fortschritte Der Zoologie 25:137-147.

Numbers of wintering migrant sparrows are positively correlated with grass seed production which varies with the amount of summer rainfall. Resident sparrows are winter-food limited every

few years when summer rainfall is low. Facultative migrators remain in northern parts of their winter ranges in years of high grass seed production. Migrant sparrow populations are regulated in years of low seed production when they saturate their wintering grounds.

1978

*Appleton, Ariel. 1978. **Bolson Tortoises (G*opherus flavomarginatus)* at the Research Ranch.** Desert Tortoise Council, Proceedings of the 1978 Symposium: 164-174.

Details of the habits and reproductive lives of a captive colony of five Bolson tortoises are reported for over a period of 5 years. Included also is a panel discussion regarding the best ways \o continue base-line studies, to classify them as an endangered species and to cooperate with the Mexican government on on-going research.

*Bock,C.E., J.H. Bock. 1978. **Response of Birds, Small Mammals, and Vegetation to Burning of Sacaton Grassland in Southeastern Arizona.** J. Range Management 31:296-300.

Fire appears to benefit indigenous plants and wildlife of sacaton communities, as long as a mosaic of different aged stands is maintained. Burning reduced the height and extent of sacaton *(Sporobulus wrightii)* itself, and stimulated growth of other grasses and forbs. Summer fires created more bare ground and encouraged a greater number and variety of annuals than the winter fire -- total small mammal populations were reduced while bird populations were greatly increased as a result of summer fires.

*Korte, N.E., J.L. Moyers. 1978. **The Concentration of Inorganic Species in Airborne Respirable Particulate Matter in Rural Southern Arizona.** J. Arizona-Nevada Academy of Science, October 1978, 13:3:79-83.

Large particles are primarily wind blown soil material, whereas the small particles (with implications for public health and regional visibility) are composed of soil material, gaseous oxidation, and acid base products from distant anthropogenic or natural sources.

1977

*Bahre, C.J. 1977. **Land-use History of the Research Ranch, Elgin, Arizona.** J. Arizona Academy of Science 12(suppl.):1-32.

Cattle ranching appears to have had the greatest impact on the wild landscape in the last 90 years. Since becoming a sanctuary in 1968, the Ranch remains one of the few "control areas" in the short-grass prairies of southeastern Arizona where scientists can learn to maintain manmade climax communities in southern Arizona without destroying the environment upon which they are based.

*Nicholson, R.A., C.D. Bonham. 1977. **Grama (*Bouteloua* Lag.*)* Communities in a Southeastern Arizona Grassland.** J.Range Management 30:427-433.

Black grama (*Bouteloua eriopoda*) was found to be associated with soils higher in nitrate, potassium, organic matter, pH, and lime. Most similar to stands of black grama were stands of eludens grama (*B.eludens)* and sideoats grama (*B.curtipendula)*, which tended to also be associated with sandy clay textured soils and steep, rocky slopes. All stands of eludens grama were found on southerly exposures. Hairy grama (*B.dirsuta*) and spruce-top (*B.chondrosiodes)* were most widely distributed and tended to occur together on relatively level sites with clayey, acidic soils. Curly mesquite (*Hilaria belangeri)* was nearly always associated with these two gramas. Blue grama (*B. gracilis*) tended to be most abundant on acidic, relatively infertile, sandy clay loam soils.

Post, Donald F., Photographer. Cover picture of Audubon Research Ranch. Journal of Soil and Water Conservation. July-August 1977, Vol. 32/No.3. Front cover.

The cover picture note: This quality rangeland in southeastern Arizona, which begins to green during the summer rainy season, has a recommended carrying capacity of 16 to 20 animal units per section per year.

*Pulliam, H.R., G.S.Mills. 1977. **The Use of Space by Wintering Sparrows.** Ecology 58:1393-1399.

Differences in microhabitat utilization by sparrows wintering in southeastern Arizona may be sufficient to explain their coexistence. The species either forage in different macro habitats or in the same habitat at different distances from tree or shrub cover.

1976

*Bock, J.H., C.E. Bock, J.R. McKnight. 1976. **A Study of the Effects of Grassland Fires at the Research Ranch in Southeastern Arizona.** J.Arizona Academy of Science 11:49-57.

Two fires that occurred in grassland and oak-savannah, spring, 1974, were studied through two post-fire growing seasons. The grass cover was reduced initially by the fires and growth of herbs encouraged. After the second post-fire growing season, both burned plots were 90% similar to their respective controls. Thirteen of nineteen bird populations were larger on the burned plots than on their controls. Small mammals showed no significant increases on the burn, and in four of sixteen cases they showed significant decreases. The flora and fauna of the Ranch do not appear to have experienced any permanent alterations as a result of these fires.

+Mills, G.S. 1976. **American Kestrel Sex Ratios and Habitat Selection.** Auk 93-740-748.

Differential habitat utilization by the sexes of wintering kestrels is widespread. Females are more often found in open, sparsely vegetated habitats and males more often found in habitats of denser vegetation. Habitat separation in summer may also be widespread, but perhaps not to the extent as in winter.

1975

*Brand, M.R. 1975. **Determination of Rodent Diets Using a Micro-technique of Fecal Analysis.** M.S. Thesis, Department of Biological Sciences. U.of AZ, Tucson. 40 pgs.

This technique proved too error-prone to be useful in determining the relative proportions of seed species present in the diets of seed-eating rodents.

*Moyers, J.L., L.E. Ranaweiler, S.B. Hopf, N.E. Korte. 1975. **An Evaluation of Particulate Trace Species in the Southwest Desert Atmosphere.** 29 pgs. Unpubl.

Airborne soil and crustal material account for the majority of suspended particulate matter in both urban and rural locations. Urban activities are the source for every measured chemical species. Acid-base nature of atmospheric gases and aerosols is apparently responsible for defining sulfate speciation and gas-particle distribution of volatile acid-base species.

*Pulliam, H.R. 1975. **Coexistence of Sparrows: a Test of Community Theory.** Science 189:474-476.

A study of the coexistence of sparrows in grassland and woodland habitats of the Research Ranch supports the predictability of current community theory. For each of the habitats studied, the production of seeds and the abundance of seed-eating winter-resident sparrows were measured. The theory correctly predicts the number of species supported in each of the habitats. In both the cases for which the prediction is that only one species could be supported, the theory correctly predicts which species should be present.

*Pulliam, H.R., M.R. Brand. 1975. **The Production and Utilization of Seeds in the Plains Grasslands of Southeastern Arizona.** Ecology 56:1158-1166.

Following winter rains, seeds are produced which are subject to relatively high predation by ants and rodents. Following summer rains, seeds are produced which are subject to relatively high predation from sparrows and rodents but not ants. The seed selection by ants and sparrows have apparently been important in determining the evolution of seed shape. Seeds which are easiest for ants to carry or sparrows to crack happen to be produced when ants are underground or sparrows switch their diet to insects, making the survival of the seed more probable.

1974

*Schickedanz, J.G. 1974. **Seasonal Growth, Development, and Carbohydrate Reserves of Three Native Range Grasses in Response to Seasonal Moisture and Nitrogen Fertilization.** Ph.D. Thesis, Department of Watershed Management. U. of AZ, Tucson. 76 pgs.

Grazing management systems for blue grama (*Bouteloua gracilis)*, sprucetop grama (*B. chondrosioides)*, and poverty threeawn (*Aristida divaricata*) must consider several critical growth periods. Times of beneficial rest for the plants would be: 1) autumn-- blue grama is producing new shoots, and sprucetop grama and poverty threeawn are in carbohydrate reserve accumulation; 2) early spring-- all three species accumulate carbohydrate reserves; and 3) early summer-- plant leaf and root growth is accelerated and carbohydrate reserves are low.

*Sule, B. 1974. **Growth, Development, and Carbohydrate Reserves of Sideoats Grama and Plains Lovegrass.** M.A. Thesis. Department of Watershed Management. U. of AZ, Tucson. 36 pgs.

Carbohydrate reserves in sideoats grama *(Bouteloua curtipendula)* declined at the beginning of the summer growing season (June) reaching a low in August and a peak in early November. New root growth was observed only in July and August. The period of major accumulation of reserve carbohydrates for plains lovegrass *(Eragrotis intermedia)* occurred November to early December. New root growth was nonexistent from November to February. Sideoats grama should benefit from periodic reduced grazing pressure from July to early November. Plains lovegrass should benefit not only from reduced grazing pressure during the summer and fall but also in the winter.

+Vice, D.H. 1974. **Geology and Petrography of the Babocomari Ranch Area.** M.A. Thesis. AZ. State U., Tempe. 152 pgs.

An east-west trending thrust fault is the major structural feature of this area. Several high-angle normal faults and small, tight folds in the upper plate, and minor folding and extensive faulting in the lower plate appear to be related to the thrust fault. Extensive small-scale folding is present in the Permian units of the west end of the Babocomari Ranch. Erosion by the Babocomari River during the late or middle Pleistocene has left a complex sequence of five paired terraces within the study area.

*White, S. 1974. **Seed and Vegetation Patterns with Respect to Grazing on a Southern Arizona Grassland Rangeland.** M.S. Thesis, AZ State U., Tempe. 139 pgs.

Furrowing and reseeding in the 1950s created distinct banded patterns of vegetation that persisted on the ungrazed, but not on the grazed area. A higher percentage of forb and shrub cover, and higher numbers of forb seeds on grazed areas, suggested that grazing created openings available to the establishment of other plants. Note: The furrowing bands had also disappeared on the ungrazed areas, when observed in 1994.

1973

*Fish, E.B. 1973. **Phytosociology Studies of a Desert Grassland Site.** Ph.D. Thesis. U. of AZ. Tucson. 46 pgs.

In terms of time and cost relations, the best method to summarize and order phytosociological data is to use the factor/cluster analysis after the use of more rapid qualitative methods to initially stratify the study area.

*McLendon, T. 1973. **Gross Energy Distribution and Vegetation Pattern Characteristics for a Shrub Community in Arizona.** M.A. Thesis, Range Science Department. CO State U., Fort Collins, CO. 53 pgs.

Solar radiation conversion efficiencies of major plant species within a native grassland vegetation type were studied and the patterns of gross energy distribution of the native vegetation described.

Peplow, E.H., Jr. 1973. **A Shangri-la for Ecologists. Arizona Highways, Sept. 1973:Vol. XLIX #9: pp.14-15, 46-47.

The aims and history of TRR are relayed from its acquisition in 1959 to 1973.

1972

*Bonham, D.D. 1972. **Ecological Inventory Information Storage-Retrieval System for the Research Ranch.** Range Science Department, Science Series #14. CO State U., Fort Collins.

Report includes basic inventory of the vegetation and soils of the area.

*Nicholson, R.A. 1972. **Grama Communities in a Southern AZ Grassland.** Ph.D. Thesis. Range Science Department. CO State U., Fort Collins. 108 pgs.

Sprucetop grama (*Bouteloua chondrosioides*) was more abundant on the higher, flatter open areas having somewhat acidic soils. Sideoats grama (*B.curtipendula*) was most abundant on steep rocky sites with alkaline soils. Stands of blue grama (*B. gracilis)* were characteristically found in flat swales with sandier soils which are low in pH, nitrates, potassium, and rock.

1970

*Bonham, C.D. 1970. **Elgin Research Ranch Data Retrieval and 3-dimensional Plotting System.** Designed for Elgin Research Ranch by Dr. Bonham (Co State U.) in cooperation with Ken Foster.

An investigator can retrieve any of 500 variables and plot it in three 3-dimensions on any desired scale to determine variation and causes over the entire Research Ranch.

1967

*Burkholder, D.A. 1967. **Interspecific Differences among Five Southern Desert Grasses as Affected by Varying Moisture and Fertilizer Levels.** M.S. Thesis, U. of Az. Tucson. 49 pgs.

Black grama and poverty threeawn responded differently than the other 3 species (sprucetop grama, sideoats grama and blue grama) in the greenhouse studies to varying moisture and fertilizer levels. The greatest difference among species in the field was related to a change in phosphorus content with fertilization.

1963

+Pratt, J.J. 1963. **Checklist of Fauna & Flora of Fort Huachuca.** Fort Huachuca, AZ. Unpubl.

List includes over 80 mammals, over 200 species of birds, and more than 65 species of reptiles found in the Fort Huachuca area. Trees shrubs, grasses, and other plants are also listed.

1956

+Humphrey, R.R., A.L. Brown and A.C. Everson. 1952. **Common Arizona Range Grasses: Their Description, Forage Value, and Management.** Agricultural Experiment Station, Univ. of AZ, Tucson. 77 pgs.

List includes 53 range grasses important to the state of Arizona and gives their identifying characteristics, seasonal forage values, and the management practices that will maintain each grass in a productive condition.