

NSRL NEWS

Natural Science Research Laboratory
Museum of Texas Tech University

Volume 4, Spring 2017



Research Highlight: Threatened and Endangered Species Research

by Richard Stevens

Impacts that large museum collections have on contemporary biological research are substantive and multifaceted. Obvious examples are facilitation of much of contemporary research on evolution, systematics, morphometrics, and anatomy of the recent and fossil biota via loans and examination of museum holdings. Less obvious is that collections-based research goes hand-in-hand with conservation and management of threatened and endangered species, and two ongoing research projects conducted collaboratively by NSRL personnel provide good examples.

Status of the Texas Kangaroo Rat

The Texas Kangaroo Rat (*Dipodomys elator*) is currently endemic to 10 counties in north-central Texas. This species appears to have experienced substantive and rapid declines in abundance across its geographic range, and as a result is being considered for listing under the Endangered Species Act. Because of the urgent nature of conservation of species protected under the Endangered Species Act, the

decision to list a species is often hasty and based on little contemporary information on distribution, abundance and viability. This grant, awarded to Richard Stevens, Robert Bradley, David Ray, and Neal Platt by the Texas Comptroller of Public Accounts, will provide detailed information that is crucial for an informed decision on whether to provide Texas Kangaroo Rats with elevated protection. Specifically, we aim to re-document the distribution of this species in the state, quantify its microhabitat and macrohabitat affinities, examine spatial patterns of genetic structure, and model its response to current and future climate within its geographic range.

All of these objectives rely on and contribute to the holdings of contemporary museum collections. Although specimens exist in at least 12 other collections, the NSRL has in its holdings perhaps half of all *Dipodomys elator* specimens in the world. As one objective, we used voucher specimens to provide verified locations in order to parameter-



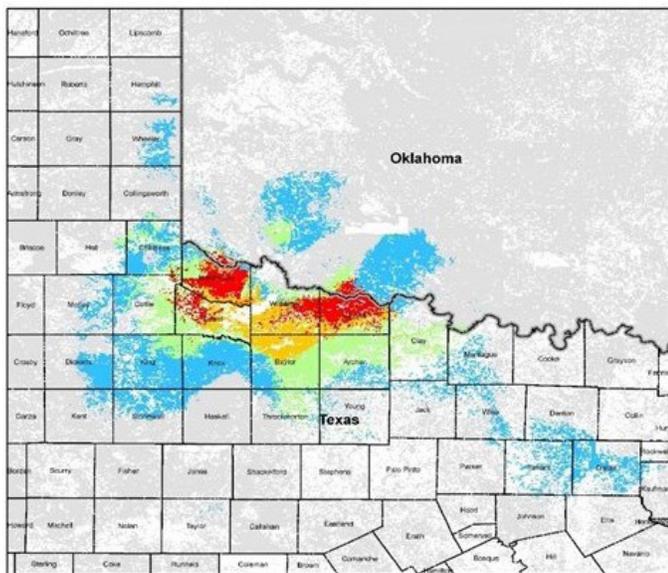
*Michaela Halsey extracting DNA from *Dipodomys elator* whiskers using the Qiagen DNeasy kit. Extracting whiskers is a non-invasive technique being developed by us to collect DNA from threatened and endangered species. These data will inform her Ph.D. dissertation on the population genetics and metapopulation structure of Texas Kangaroo Rats.*



*John Stuhler examining specimens of *Dipodomys elator* in the collection at the NSRL. John will use these specimens as vouchered georeferences to parameterize the Ecological Niche Model. This research is part of his Ph.D. dissertation.*

ize an Ecological Niche Model that describes spatial extent of the geographic range of this species. This niche model also ranks sites based on suitability and allows us to identify areas where these kangaroo rats are most likely to be found and the kinds of habitats they prefer. We also used this model to further guide our research on more in-depth studies of habitat selection of this species.

Tissue samples obtained from the ongoing research, as well as existing tissue samples in the NSRL's Genetic Resources collection, will be used to examine spatial patterns of genetic structure of Texas kangaroo rats. Such analyses provide valuable diagnostics as to genetic diversity that is important for the continued viability of this species. The research also will identify how many genetic populations exist, which can then be used to make important conservation and management decisions.



Ecological Niche Model of the Texas Kangaroo Rat in Texas and Oklahoma based on climate, soil, and 2011 land cover data. Warmer colors indicate areas of high probability of occurrence; cooler colors indicate low probability of occurrence. White areas are outside the distribution of the Texas kangaroo rat but were included to better parameterize the niche model.

Given the need for genetic material, our efforts involve destructive sampling of a finite resource, namely tissue samples held in the Genetic Resources Collection. Nonetheless, research funded by the Comptroller has facilitated our ability to build scientific infrastructure by “putting back” and contributing more than 750 specimens of other non-target species across 12 counties in Texas.

Ecology and Systematics of the Long-eared Bat in Louisiana

White-nose syndrome (a result of infection by the fungus *Pseudogymnoascus destructans*) is an emerging disease of bats that use caves to hibernate during winter. The disease

has devastated populations of Northern Long-eared Bats (*M. septentrionalis*), Little Brown Bats (*Myotis lucifugus*), Small-footed Bats (*M. leibii*), Tricolored Bats (*Perimyotis subflavus*), and to a lesser extent, Big Brown Bats (*Eptesicus fuscus*) in the eastern United States. Northern Long-eared Bats were recently discovered in Louisiana, and since then, the species has been listed as threatened under the Endangered Species Act.

As part of a series of grants awarded by Louisiana Department of Wildlife and Fisheries, US Forest Service, and the US Fish and Wildlife Service, Richard Stevens and David Ray are examining the roosting ecology and population genetics of Northern Long-eared Bats in Louisiana, annotating a recent genome draft, and examining systematic relationships among populations distributed throughout North America.

Special circumstances exist in Louisiana that may be important to the persistence of *M. septentrionalis* in North America, and better understanding ecology and systematics in this region of its range will be crucial for future viability of this species. First, Northern Long-eared Bats represent a viable population in the state. In addition to the initial record of three *M. septentrionalis* at one site in Winn Parish, additional records exist for Winn and Catahoula districts of the Kisatchie National Forest. Moreover, we have docu-



Carlos Garcia is locating a transmittered bat with a telemetry receiver. He is conducting his MS thesis research on roosting affinities of Northern Long-eared Bats in Louisiana.

mented this species in an additional three parishes as part of our statewide culvert survey for bats, which was funded by the Louisiana Wildlife and Fisheries State Wildlife Grant Program. We have encountered this species in both summer and winter, which suggests that Louisiana *M. septentrionalis* are not just summer migrants that winter in caves somewhere else, but are year-round residents. Importantly, there are virtually no caves in Louisiana. To this end, this viable Louisiana population winters in structures other than caves, likely tree hollows, under bark, in culverts, or in leaf litter on the ground. Louisiana may serve as an important refuge from *P. destructans* for this species, perhaps one of only a few WNS-free areas within its geographic range. If this is the case, northern Louisiana could represent a refugium for this species in North America. Moreover, if extinction is prevented, northern Louisiana could be an important staging

area for future conservation and recolonization of its original range if this epidemic were to come to an end.

Other than a few geographic records of presence, nothing is known regarding the basic ecology of *M. septentrionalis* in Louisiana. Fortunately, between Louisiana Department of Wildlife and Fisheries wildlife management areas, US Forest Service national forest land, and US Fish and Wildlife refuges, there is much public land in Louisiana on which to manage populations of *M. septentrionalis* in perpetuity. Nonetheless, without basic information on the ecology of this species, management decisions cannot be properly informed. Further survey work and characterization of habitat variables important to *M. septentrionalis* are urgently needed to better manage this species. One of the most important environmental characteristics for bats and one that is the most manageable in forested systems are available roosts. Nonetheless, nothing is known regarding summer or winter roosting of *M. septentrionalis* in the southern portion of its range such as in Louisiana where there are no caves. We have initiated a telemetry study to determine differences between roosting and non-roosting sites of Northern Long-eared Bats. Such information will be instrumental for managing forests for particular stand characteristics so as to enhance used by this bat species.

Systematic uncertainty exists in terms of our current understanding of the taxonomic limits of *M. septentrionalis*. We have observed that bats from the newly discovered Louisiana population appear different than in other areas. In particular, characteristics such as long ears and tragi that are distinctive in other geographic areas are not distinctive in Louisiana. Such morphological variation suggests that the form that is in Louisiana may be a distinct subspecies or even species. We also will examine population genetic structure by comparing genetic diversity to other populations in Nebraska, Kentucky, Missouri, and Arkansas.

In a similar fashion as the research on Texas Kangaroo Rats, this project uses and contributes to the collections of the NSRL. This project has contributed more than 500 specimens from eight non-target species of bats distributed throughout 40 different parishes in Louisiana.



A “fully loved” Northern Long-eared Bat. After capture in a mist net, each individual is removed from the net, sexed, aged, weighed, fitted with an aluminum arm band, and fitted with a 0.5g telemetry transmitter. We have spent many a night discussing what these bats’ buddies must say when they show up back at the roost later in the night...better yet must be the story that the transmitted bat tells.

OUTREACH NEWS AND EVENTS

Robert Bradley was interviewed by the *Lubbock Avalanche-Journal* for an article about skunks entitled “South Plains skunks out and about in ‘fall shuffle.’” <http://www.nsr1.ttu.edu/about/Media/South%20Plains%20skunks%20Lubbock%20Avalanche-Journal.pdf>

Liam McGuire’s research on white-nose syndrome in bats was highlighted in *Texas Tech Today*. <http://today.ttu.edu/posts/2016/10/bats>

David Ray was invited to present a seminar at the University of Central Oklahoma. His seminar was entitled “Genomics, Transposable Elements, and Non-traditional Model Organisms.”

Tigga Kingston led the 4th SEABCRU Research Coordination Network Meeting, November 2016, in Langkawi, Malaysia. At least 30 researchers from across Southeast Asia were in attendance.

NSRL FACULTY CURATORS



Dr. Robert D. Bradley is Director of the NSRL, Curator of Mammals, and Professor of Biological Sciences. Dr. Bradley's research foci are systematics and molecular evolution of New World rodents; hybridization; infectious zoonotic diseases; and natural history of mammals. He has been a faculty member since 1994. He is currently directing 3 PhD and 4 MS students. He has graduated 19 MS, 2 MA, and 11 PhD students, and he has published 165 peer-reviewed articles.

robert.bradley@ttu.edu



Dr. Nancy McIntyre is the NSRL Curator of Birds and a Professor of Biological Sciences. She is a landscape ecologist whose research focuses on how land conversion and climate change are fragmenting migratory habitats for wildlife in the Great Plains of North America. Dr. McIntyre has served as Curator of Birds since 2006. She is currently advising or co-advising 1 MS and 2 PhD students.

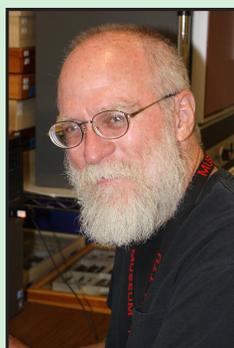
nancy.mcintyre@ttu.edu



Dr. Caleb D. Phillips is the Curator of Genetic Resources of the NSRL and an Assistant Professor of Biological Sciences. The Phillips' lab studies how gene expression and microbiome communities evolve in support of mammalian life histories; bioinformatics; and the evolutionary/developmental process of mammalian divergence. He is currently advising 3 PhD, 1 MS, and 2 undergraduate students.

caleb.phillips@ttu.edu

NSRL CURATORIAL AND SUPPORT STAFF



James Cokendolpher retired from Texas Tech University in August 2016 (see article on page 13). James was the NSRL Assistant Curator of Invertebrate Zoology and a Research Scientist. In the near future, the NSRL will be seeking a Collections Manager for the Invertebrate Zoology Collection to fill the role previously served by James.



Heath Garner is the NSRL Curator of Collections. His role is to facilitate the daily operations and maintenance of the NSRL collections. His duties include specimen processing, cataloging, and tracking, loan processing, student worker and volunteer training and supervision, documentation, and collections preventative conservation.

heath.garner@ttu.edu



Kathy MacDonald is the Collections Manager for the Genetic Resources Collection. Her primary duties include the organization and processing of incoming samples and the subsampling and processing of loans. Other duties include maintaining the NSRL website, assisting with specimen tracking in the collections, and data management and design.

kathy.macdonald@ttu.edu



Lisa Bradley is the Production Editor for Occasional Papers and Special Publications. Her duties include coordinating the review and revision process, copy editing, and final layout and design. She also assists in the writing and editing of scientific articles published by NSRL staff, the preparation of grant proposals, and the development of NSRL exhibits for the Museum.

lisa.bradley@ttu.edu

NSRL COLLECTIONS - SUMMARY AND STATISTICS

The Natural Science Research Laboratory (NSRL) is a division of the Museum of Texas Tech University that archives biological samples and their associated data. These collections serve as a library of our natural heritage for education and research purposes. Natural history collections provide the foundation for our understanding of biodiversity. They serve as a historical reference for documenting changes in our environment and the effects of those changes on wildlife and, ultimately, on humans.

The collections maintained by the NSRL are available to researchers at academic, scientific, and government institutions around the world for scientific investigation, discovery, and problem-solving in the natural sciences. The causes and/or effects of animal-borne diseases, environmental pollutants, parasites, climate change, habitat loss, geographic isolation, and natural evolutionary processes and speciation are just a few examples of the investigations that can be conducted utilizing specimens and tissues archived in a natural history collection. Further, the resources of the NSRL are utilized by the academic and scientific communities to train and educate students at the undergraduate and graduate levels for careers in the natural sciences as well as museum science.

Mammal Collection



The Mammal Collection currently contains 129,176 cataloged specimens of an estimated 1,441 species. Specimen preparation types include preserved skins, skeletal materials, alcohol-preserved specimens, and taxidermy mounts. From July through December 2016, the Mammal Collection cataloged 3,372 specimens and granted 10 loans of 108 specimens.

Bird Collection



The Bird Collection currently contains 5,518 cataloged bird specimens, as well as eggs and nests, of approximately 890 species. From July through December 2016, the Bird Collection cataloged 1 new specimen.

Invertebrate Zoology Collection



The Invertebrate Zoology Collection contains an estimated 4.5 million specimens. These include insects, crustacea, endo- and ecto-parasites, and arachnids. Specimen preservation methods include dried, fluid (ethanol or formalin), slide-mounted, and frozen. From July through August 2016, the collection staff cataloged 1,271 specimens. The entire catalog may be searched here: <http://symbiota4.acis.ufl.edu/scan/portal/collections/>

Genetic Resources Collection



The Genetic Resources Collection contains >355,000 samples of tissues, blood, and extracted DNA from >98,000 specimens of mammals and other taxa. From July through December 2016, the GRC granted 23 loans totaling 896 samples. The Collection grew by 12,107 samples obtained from 2,288 individuals.

As a whole, the NSRL hosted 249 visitors from July through December, including researchers utilizing the collections, students taking classes, and individuals and groups on tours. The NSRL also filled 78 data requests by researchers. Twenty-eight students (16 graduate, 12 undergraduate) were employed by the NSRL during all or part of the July through December time period.

FACULTY AND STAFF GRANTS (active July–December 2016)

Bradley, R. D. “Natural History: Development of a liquid nitrogen system for the Genetic Resources Collection, Natural Science Research Laboratory, Museum of Texas Tech University”. NSF (Collections in Support of Biological Research).

Griffis-Kyle, K., and **N. McIntyre**. “Synergistic links between ecological traps and climate change in metapopulation dynamics: The keystone role of arid wetlands.” Texas Tech University Proposal Support Program.

Griffis-Kyle, K. L., and **N. E. McIntyre**. “Landscape connectivity of isolated waters in the Sonoran Desert for wildlife.” U.S. Bureau of Reclamation - Desert and Southern Rockies Landscape Conservation Cooperatives.

Griffis-Kyle, K. L., and **N. E. McIntyre**. “Assessment of landscape conservation success for non-target species at risk.” Western Association of Fish & Wildlife Agencies - Grassland Initiative.

Hoffmann, F., and **D. Ray**. “piRNA dynamics in the absence of active TEs.” National Science Foundation.

Johnson, E., and **R. D. Bradley**. “From the African Savannah to the North American Grassland - an Up From the Basement exhibit.” Helen Jones Foundation.

Kingston, Tigga. “Southeast Asian Bat Conservation Research Unit.” National Science Foundation.

Longing, S., R. Cox, **N. McIntyre**, C. McKenney, and C. West. “Demonstration of pollinator conservation practices and a framework for regional implementation on the Southern High Plains.” USDA Natural Resources Conservation Service - Conservation Innovation Grants.

McGuire, L. P. “Bat migration across Lake Erie: Implications for offshore wind energy development.” Pennsylvania Department of Environmental Protection, Coastal Zone Management Program.

McIntyre, N. E., and K. Hayhoe. “Collaborative proposal: Climatic and anthropogenic forcing of wetland landscape connectivity in the Great Plains.” NSF-Macrosystems Biology.

Olson, S. H., **L. P. McGuire**, R. K. Plowright, D.T. S. Hayman, B. G Dickson, C. L. Lausen. “Assessing white-nose syndrome in the context of nonstationary conditions in an advancing continental epidemic.” Department of Defense, Strategic Environmental Research and Development Program.

Pardiñas, U., et al. (**J. Salazar-Bravo** is one of 4 coPIs). “Hacia una filogenia integral de los roedores sigmodontinos (Mammalia, Rodentia, Cricetidae)” (Towards an integral phylogeny of Sigmodontine Rodents (Mammalia, Rodentia, Cricetidae). Argentinean Science Foundation.

Ray, D., R. D. Stevens, and R. D. Bradley. “Population and conservation status of Texas pocket gophers (*Geomys* and *Thomomys*) in Texas with a focus on the subspecific status of *Thomomys bottae* via populations genomic tools.” Texas Parks and Wildlife Department.

Ray, D., and R. D. Stevens. “Comparing genetic diversity of the threatened northern long-eared bat across their range using whole-genome and RADSeq approaches.” USDA Forest Service.

Rico-Cernohorska, A., **J. Salazar-Bravo**, et al. “Generación de fortalezas para la determinación de enfermedades zoonóticas en el norte de La Paz (PBE4 - Phase II). Proyectos Concursables De Investigacion E Interaccion Social (IDH), Bolivia.

Salazar-Bravo, J. “Multiple dimensions of host-pathogen biodiversity: rodents, virus in South American habitats.” Texas Tech University’s International Research Seed Grants competition.

Stevens, R. D. “Habitat affinities and day roost characteristics of the northern long-eared bat (*Myotis septentrionalis*) in Louisiana.” USFWS/Louisiana Department of Wildlife and Fisheries.

Stevens, R. D. “Winter day-roost characteristics of the northern long-eared bat (*Myotis septentrionalis*) in Louisiana.” U.S. Forest Service.

Stevens, R. D., and M. Barnes. “White-nose Syndrome (WNS) surveillance in Louisiana.” USFWS/Louisiana Department of Wildlife and Fisheries.

FACULTY AND STAFF GRANTS (cont.)

Stevens, R. D., and S. Fritz. “Fort Wolters bat surveys.” Texas Army National Guard.

Stevens, R. D., D. Ray, R. N. Platt, and R. D. Bradley. “RFP No. 209f for Endangered Species Research Projects for the Texas Kangaroo Rat.” Texas State Comptroller.

Williams, G., J. Cañas, J. Dwyer, S. Jang, and **N.E. McIntyre.** “RMR-TTU: Recruitment, mentoring, and research in mathematics and science at Texas Tech University.” NSF-PRISM (Proactive Recruitment in Introductory Science and Mathematics).

UNDERGRADUATE RESEARCH

During July–December 2016, 26 undergraduate students were conducting research under the direction of 6 NSRL faculty associates.

STUDENT PRESENTATIONS

During the period July through December 2016, at least 11 graduate students gave 9 oral and 5 poster presentations of their research at 8 national and international conferences and society meetings. One student won an award for their presentation:

Elizabeth Rogers. Graduate student. Organization for Bat Conservation award (poster presentation), North American Society for Bat Research.



Undergraduate student Whitney Watson conducts research in the laboratory of Dr. Robert D. Bradley. Photo source: <https://www.depts.ttu.edu/artsandsciences/students/prospective/whitneywatson.php>

STUDENT GRANTS AND AWARDS

Jeff Clerc. Graduate student. AT&T Chancellors Fellowship, Texas Tech University.

Marina Fisher-Phelps. Graduate student. Cash Family Graduate Fellowship, Texas Tech University.

James Q. Francis. Graduate student. J Knox Jones Memorial Endowed Scholarship, Texas Tech University.

Lucas Heintzman. Graduate student. Elo and Olga Urbanovsky Assistantship; US Chapter of the International Association for Landscape Ecology Travel Award; TTU Graduate School Travel Award.

Adrian Jasso. Undergraduate student. The Center for Active Learning and Undergraduate Engagement, Texas Tech University.

Macy Madden. Graduate student. AT&T Chancellor’s Graduate Fellowship, Texas Tech University; American Society of Mammalogists, Grants in Aid; Texas Tech University Association of Biologists; J. Knox Jones, Jr. Memorial Endowed Scholarship, Biological Sciences, Texas Tech University; Bat Conservation International.

Cristina Rios Blanco. Graduate student. Travel Award, American Society of Mammalogists; Grant in Aid of Research, Texas Tech University Association of Biologists.

Emma K. Roberts. Graduate student. Michelle Knapp Fellowship, Biological Sciences, Texas Tech University.

Elizabeth Rogers. Graduate student. J.T. and Margaret Talkington Graduate Fellowship, Texas Tech University.

Scott Starr. Graduate student. Water Conservation Research Fellowship; TTU Doctoral Dissertation Completion Fellowship; US Chapter of the International Association for Landscape Ecology Travel Award; TTU Graduate School Travel Award; TTU Graduate School Summer Dissertation Research Award.

John Stuhler. Graduate student. Grant in Aid of Research, American Society of Mammalogists; Grant in Aid of Research, Texas Tech University Association of Biologists.

Iroro Tanshi. Graduate student. Bat Conservation International/Marie Morgan Student Research Fellowship; Michelle Knapp Memorial Graduate Research Award, Biological Sciences, Texas Tech University.

OCCASIONAL PAPERS AND SPECIAL PUBLICATIONS OF THE MUSEUM OF TEXAS TECH UNIVERSITY

The NSRL produces two peer-reviewed publication series, Occasional Papers and Special Publications, both of which are edited by Dr. Robert D. Bradley, Director of the NSRL. These series provide outlets for scholarly works resulting from museum-based natural history research. Relevant topics include, but are not limited to, taxonomic studies, faunal lists, species descriptions, zoonoses research, distributional records, and field and museum techniques and methodology, including molecular methods that are applicable to field or museum research. Publication in these series is available to all authors without regard to their association with Texas Tech University. Authors who plan to submit manuscripts to these series should refer to both the Museum Publications Policy and the Guidelines and Procedures for Authors, available at our website, www.nsrll.ttu.edu/publications, for more information.

Lisa Bradley serves as the Production Editor for both series. Our goal is to produce 10–12 Occasional Papers and 1–2 Special Publications per year. Feel free to contact Lisa, lisa.bradley@ttu.edu, if you are interested in submitting manuscripts or monographs to the Occasional Papers or Special Publications series.

Publications produced July–December 2016:

Occasional Paper 338. Description of a new tribe of sigmodontine rodents (Cricetidae: Sigmodontinae) with an updated summary of valid tribes and their generic contents. Jorge Salazar-Bravo, Ulyses F. J. Pardiñas, Horacio Zeballos, and Pablo Teta.

Occasional Paper 339. Patterns of genetic diversification in a widely distributed species of bat, *Molossus molossus*. Laramie L. Lindsey and Loren K. Ammerman.

Occasional Paper 340. Temporal effects and genetic diversity: An example from the Southern Plains Woodrat (*Neotoma micropus*). Francisca M. Méndez-Harclerode, Richard E. Strauss, Charles F. Fulhorst, Mary L. Milazzo, Donald C. Ruthven III, Christopher D. Dunn, and Robert D. Bradley.

Occasional Paper 341. Merriam's Shrew (*Sorex merriami*) in the diet of a Mexican Spotted Owl (*Strix occidentalis lucida*) from Grant County, New Mexico. Simon P. Tye, Keith Geluso, and Mike R. Fugagli.

Occasional Paper 342. Noteworthy records of shrews from the Panhandle of Texas. Emily A. Wright, Emma K.

Brookover, Brandon A. Gross, James Q. Francis, and Robert D. Bradley.

Occasional Paper 343. New distributional records of mammals in Texas. Carlos J. Garcia, James Q. Francis, Cristina Rios-Blanco, John D. Stuhler, Garret D. Langlois, Erin E. Bohlender, Macy A. Madden, Christopher D. Dunn, Robert D. Bradley, and Richard D. Stevens.

Occasional Paper 344. Assessment of genetic diversity within populations of *Neotoma albigula* (White-throated Woodrats) naturally associated with Tacaribe serocomplex viruses (Family Arenaviridae). Michelle L. Haynie, Ken D. Abbott, Charles F. Fulhorst, and Robert D. Bradley.

Special Publication 65. Contributions in natural history: A memorial volume in honor of Clyde Jones. Richard W. Manning, Jim R. Goetze, and Franklin D. Yancey, II (editors).

View and download Occasional Papers and Special Publications at the NSRL website:

www.nsrll.ttu.edu/publications



In August, Heath Garner and graduate students showed off some of the NSRL's specimens and visited with students about the NSRL's purpose and value during the annual "Hack the Museum" event. The event is part of campuswide "Raider Welcome Week" activities for new students each August. "Hack the Museum" is intended to excite and inform TTU students, both new and current, about all the Museum has to offer; and to encourage visitation and engagement by students throughout their time at Texas Tech.

RECENT PUBLICATIONS BY NSRL FACULTY, STAFF, AND STUDENTS

- Andere, A., R. N. Platt II, D. A. Ray, and C. Picard. Genome sequence of *Phormia regina* Meigen (Diptera: Calliphoridae): Implications for medical, veterinary and forensic research. *BMC Genomics* 17:842.
- Boyles, J. G., L. P. McGuire, E. Boyles, J. Reimer, C. Brooks, R. Rutherford, J. O. Whitaker Jr., and G. F. McCracken. Physiological and behavioral adaptations in bats living at high latitudes. *Physiology and Behavior* 165:322-327.
- Bradley, R. D., M. Nuñez-Tabares, T. J. Soniat, S. Kerr, R. Russell, and N. Ordóñez-Garza. Molecular systematics and phylogeography of *Peromyscus nudipes* (Cricetidae: Neotominae). Pp. 201-213 in *Contributions in natural history: A memorial volume in honor of Clyde Jones* (R. W. Manning, J. R. Goetze, and F. D. Yancey, II, eds.). Number 65, Special Publications, Museum of Texas Tech University, Lubbock.
- Bradley, R. D., N. Ordóñez-Garza, G. Ceballos, D. S. Rogers, and D. J. Schmidly. In Press. A new species in the *Peromyscus boylii* species group (Cricetidae: Neotominae) from Michoacán, Mexico. *Journal of Mammalogy*.
- Calderon, A., C. Guzman, J. Salazar-Bravo, T. Figueiredo, S. Mattar, and G. Arrieta. Viral Zoonoses That Fly with Bats: A Review. 2016. *MANTER: Journal of Parasite Biodiversity* (ISSN 2470-8224), Occasional Papers 6, September 30, 2016. <http://doi.org/10.13014/K2BG2KWF>.
- Ceríaco, L.M.P., E.E. Gutiérrez, A. Dubois, et al. (J. Salazar-Bravo is one of 496 coauthors). Photography-based taxonomy is inadequate, unnecessary, and potentially harmful for biological sciences. *Zootaxa* 4196(3):435-445.
- Cheng T., H. Mayberry, L. P. McGuire, J. Hoyt, K. Langwig, H. Nguyen, K. Parise, J. Foster, C. K. R. Willis, A. M. Kilpatrick, and W. F. Frick. Efficacy of a probiotic bacterium to treat bats affected by the disease white-nose syndrome. *Journal of Applied Ecology*. dx.doi.org/10.1111/1365-2664.12757.
- Cook, J. A., S. Greiman, S. Agosta, R. P. Anderson, B. S. Arbogast, R. J. Baker, W. Boeger, R. D. Bradley, D. R. Brooks, R. Cole, J. R. Demboski, A. P. Dobson, J. L. Dunnum, R. P. Eckerlin, J. Esselstyn, K. Galbreath, J. Hawdon, H. Hoekstra, S. Kutz, J. E. Light, L. Olson, B. D. Patterson, J. L. Patton, A. J. Phillips, E. Rickart, D. S. Rogers, M. E. Siddall, V. Tkach, and E. P. Hoberg. Transformational principles for NEON sampling of mammalian parasites and pathogens: A response to Springer and colleagues. *BioScience* 66:917-919.
- Duncan, N. P., S. S. Kahl, C. J. Salice, R. D. Stevens, and S. S. Gray. Pronghorn habitat suitability in the Texas Panhandle. *Journal of Wildlife Management* 80:1471-1478.
- Fisher-Phelps, M., D. Schwilk, and T. Kingston. Mobile acoustic transects detect more bat activity than stationary acoustic point counts in an urban-rural landscape matrix. *Journal of Arid Environments* 136:38-44. <http://dx.doi.org/10.1016/j.jaridenv.2016.10.005>
- Garcia, C. J., J. Q. Francis, C. Rios-Blanco, J. D. Stuhler, G. D. Langlois, E. E. Bohlender, M. A. Madden, C. D. Dunn, R. D. Bradley, and R. D. Stevens. New distributional records of mammals in Texas. Occasional Papers, Museum of Texas Tech University 343:1-6.
- Haynie, M. L., K. D. Abbott, C. F. Fulhorst, and R. D. Bradley. Assessment of genetic diversity within populations of *Neotoma albigula* (White-throated Woodrats) naturally associated with Tacaribe serocomplex viruses (Family Arenaviridae). Occasional Papers, Museum of Texas Tech University 344:1-26.
- Kushak, R. I., H. S. Winter, T. M. Buie, S. B. Cox, C. D. Phillips, and N. L. Ward. (in press) Analysis of the duodenal microbiome in autistic individuals: associations with carbohydrate digestions. *Journal of Pediatric Gastroenterology & Nutrition*.
- Liu, G., F.W. Schwartz, C.K. Wright, and N.E. McIntyre. Characterizing the climate-driven collapses and expansions of wetland habitats with a fully integrated surface-subsurface hydrologic model. *Wetlands* [doi:10.1007/s13157-016-0817-9](http://dx.doi.org/10.1007/s13157-016-0817-9).
- Martin, C. M., E. B. Arnett, R. D. Stevens, and M. C. Wallace. Reducing bat fatalities at wind facilities while improving economic efficiency of operation mitigation. *Journal of Mammalogy*, In Press.
- McGuire, L. P., K. Muise, A. Shrivastav, and C. K. R. Willis. No evidence of hyperphagia during pre-hibernation in a northern population of little brown bats (*Myotis lucifugus*). *Canadian Journal of Zoology*. dx.doi.org/10.1139/cjz-2016-0110.
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Did You Know....?

A few interesting facts about the NSRL's collections.

- The NSRL's mammal holdings represent every continent of the world, at least 110 countries, and have been built on the efforts of more than 5,000 people.
- Rather than being a specimen from Lubbock, or even Texas, the NSRL's first cataloged mammal specimen (TTU-M 1) is actually a Spotted Cuscus (*Spilocuscus maculatus*) from Australia.
- The NSRL's teaching collection (uncatalogued) includes the skull of a 2-headed calf that has sockets for THREE eyes (one in the center), and two sets of jaws.
- The NSRL's Genetic Resources Collection archives several thousand bird, mouse, bat, and feline fecal samples for research.
- The NSRL's Genetic Resources Collection contains tissue samples of extinct Woolly Mammoths (*Mammuthus primigenius*); one sample is estimated to be 53,000 years old.
- The NSRL's oldest bird specimen, a warbler known as the Common Yellowthroat (*Geothlypis trichas*), was collected in 1869—54 years before the founding of Texas Tech University.
- One of the NSRL's oldest mammal specimens (of an extant species) is a Norway Rat (*Rattus norvegicus*), a non-native species collected in 1894 by Henry P. Attwater, a renowned naturalist of the 19th Century. Several animal species or subspecies are named in honor of H. P. Attwater.



Field Methods Course Trains Students to Collect and Prepare Specimens

Each summer since 1995, Dr. Robert D. Bradley has taught a Vertebrate Biology section of MUSM 5325, Museum Field Methods, in conjunction with BIOL 4301, Topics in Biology. These courses provide graduate and undergraduate students in the Museum Science, Biological Science, and Natural Resources Management programs the opportunity to travel to various locations and collect specimens (primarily mammals) for scientific research purposes. The students learn the safe and ethical methods of collecting animals with different types of traps, with nets, by hand, or by other methods, as appropriate. The students then learn how to identify the animals to species, collect data from the specimens (such as measurements, weights, locality, and habitat), collect tissue samples for genetic research, and prepare the specimens for archiving in a museum collection.

Since 1995, more than 100 undergraduate and graduate students have benefited from the training offered by this course. They also have experienced “roughing it” in the great outdoors, often camping in tents, dealing with bugs, snakes, poison ivy, and extreme weather, and going several days in a row without modern conveniences (i.e. electricity and plumbing)! For many students, this is their first true experience in the outdoors and “surviving” under such conditions! Many of the trips have taken place in foreign countries such as Mexico and Honduras, so students get the added benefit of new places, cultures, and experiences.

As many of you may know, fieldwork is not a vacation. It consists of long hours of hard work, often under adverse conditions. It generally comes filled with danger and stressful situations and other less than ideal circumstances. However, the camaraderie, fun, and learning opportunities more than make up for the temporary setbacks. It teaches young biologists the tools and tricks of the trade, plus how to regroup when things do not go as planned or when Mother Nature throws you a curve. Further, many life-long friendships get their start on field trips!

The field methods course taught by Dr. Bradley has resulted in more than 10,000 specimens being deposited in

the NSRL. These specimens often are used for the graduate or undergraduate research projects of the same students who collected them. Theses and dissertations, presentations at scientific meetings, publications in peer-reviewed journals, and ultimately careers have resulted from the experiences of these students and the specimens they collected. For many it can be a life-changing experience. Of course, the specimens collected during this annual field methods course also are made available to qualified researchers around the world through the NSRL’s loan policy, furthering the impact of these specimens on education and scientific discovery!

During the 1990s and 2000s, Dr. Bradley, colleagues, and students often traveled to various localities in Mexico to collect specimens. Since 2008, however, safety concerns have prevented expeditions to Mexico, and the course has involved travel throughout the southwestern U.S., including at least 50 localities in Texas, Oklahoma, and New Mexico. In 2016, the Field Methods crew traveled to areas near Mills Canyon, New Mexico, Black Mesa State Park in Oklahoma, and several areas across the Texas Panhandle and along the Red River. The goal was to collect specimens for several student research projects, as well as to conduct field research for the *Dipodomys elator* project (funded by a grant to Richard Stevens, David Ray, Neal Platt, and Bradley). Eleven students participated in the 2016 trip and 667 specimens were collected for research. Students were able to participate in netting bats and setting Sherman and gopher traps. Some even sifted through owl pellets and were able to write a distributional paper about the shrew skulls they identified.

As usual, the trip was packed with adventures (freezing in the mountains of New Mexico, torrential downpours in the Panhandle, and avoiding heat-stroke across the Texas Plains). Many students saw new habitats and species for the first time. Others learned how to cook on a Coleman stove, put up their tents in the dark, and prep specimens under a tree. Still others learned about horseflies (especially the painful bites), red harvester ants, and various species of cacti (spines). The students were troopers and more than pulled their weight. Together they learned a lot and made the trip a success!

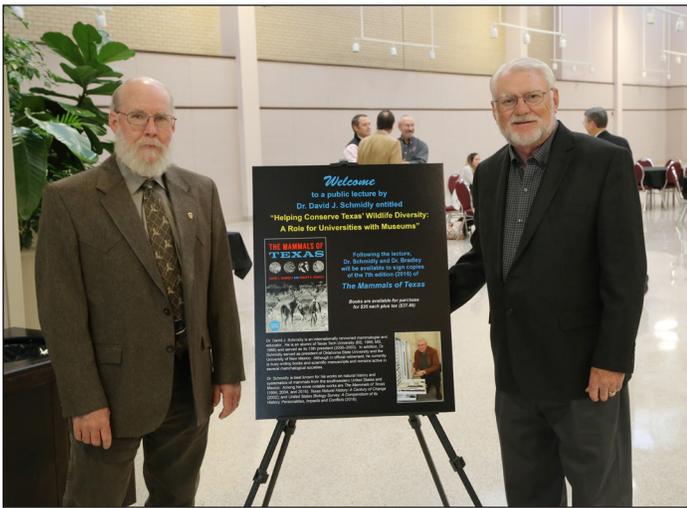


Museum Hosts Book Signing and Public Lecture by Dr. David J. Schmidly

On November 3rd, the Museum hosted an event to mark the publication of the 7th edition of *The Mammals of Texas*. This edition was co-authored by Dr. David J. Schmidly, alumnus and former president of Texas Tech University, and Dr. Robert D. Bradley, Director of the NSRL.

The event began with a public lecture by Dr. Schmidly, entitled “Helping Conserve Texas’ Wildlife Diversity: A Role for Universities with Museums.” The lecture focused on Texas mammals, natural history and conservation, and the role that natural history collections and museums play in addressing a variety of topics, including land use and agricultural practices, public education, heritage and culture preservation, policy formation, scientific resources, and a plan for the future of natural history museums.

A reception following the lecture included the opportunity to purchase copies of the book and to have them personally autographed by the authors.



AUGUST AND DECEMBER 2016 GRADUATES

Erin Bohlender, M.S. Co-chairs: Richard Stevens and Jairo Perez-Torres. Thesis title: Hormone concentrations, vaginal cytology and diet: Variations during reproduction in Seba’s Short-tailed Fruit Bat. Current position: Ph.D. student in Natural Resources Management, Texas Tech University.

Juan Pablo Carrera Estupinan, Ph.D. Chairs: Robert D. Bradley and Carleton J. Phillips. Dissertation title: Diversity, zoogeography, and community ecology of bats in the Ecuadorian Andes. Current position: Research Associate, Natural Science Research Laboratory, Texas Tech University.

Chris Dunn, M.S. Chair: Robert D. Bradley. Thesis title: Genetic Diversity and the origin of contemporary Eastern Elk (*Cervus canadensis*) populations in Texas. Current position: Laboratory Technician, School of Veterinary Medicine/ Pathobiological Sciences, University of Wisconsin-Madison.

Sarah Mangum, M.S. Chair: David Ray. Thesis title: Exploration of evolutionary relationships and LINE-1 retrotransposition accumulation/activity within sciurids. Current position: Research Scientist, Research and Testing Laboratories, Lubbock, Texas.

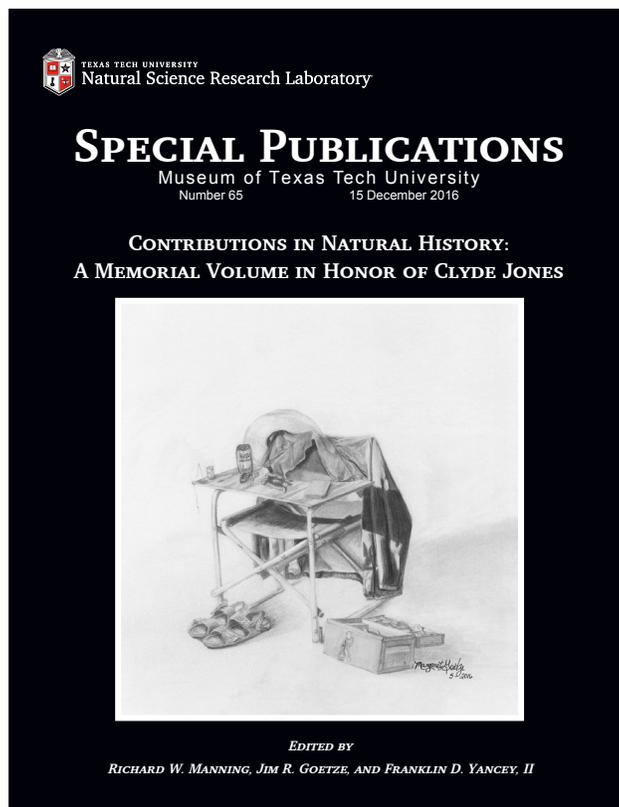
Kendra Phelps, Ph.D. Chair: Tigga Kingston. Dissertation title: Responses of cave-roosting bats to complex environmental gradients: An assessment across assemblage, species, and population levels. Current position: Research Associate and Instructor, Texas Tech University.

Former Students of Dr. Clyde Jones Collaborate to Produce a Memorial Volume in his Honor

The most recent issue of *Special Publications of the Museum* (#65, December 2016), is a memorial volume in honor of Dr. Clyde Jones (1935–2015). Richard W. Manning, Jim R. Goetze, and Franklin D. Yancey, II, who obtained their Ph.D.'s under the direction of Clyde at Texas Tech, served as editors and led the efforts to obtain contributions toward this volume. The volume includes research articles, encomia, transcripts of an oral history by Clyde, photographs, and other materials submitted by Clyde's former students and colleagues. The 11 research articles, authored or co-authored by a total of 26 individuals, include subjects varying from fossil faunal analyses, ecological and ethological studies on terrestrial and volant mammals, the description of a new species of *Myotis*, resurrection and redefinition of an 'older' species of *Peromyscus*, to a first record of an avian species in Texas. This range of topics reflects the eclectic research interests of Clyde.



Clyde was happiest in the field, trapping rats and catching bats, particularly in the Big Bend region.



James Cokendolpher Retires

Effective 31 August 2016, James Cokendolpher retired as Research Scientist and Assistant Curator of Invertebrate Zoology for the NSRL. James had served in that position since 2007. In addition to curating and managing a collection of more than 4.5 million specimens, James conducted research, authored publications, and received funding through a collaborative NSF proposal to begin digitizing the arthropods in the collection. The NSRL thanks James for his years of service to the NSRL, and we look forward to continued collaboration with James through his appointment as a Research Associate.



Hiring Soon

The NSRL will be seeking a Collections Manager for the Invertebrate Zoology Collection (IZC). The Collections Manager of the IZC is expected to have a hands-on approach involving the care, management, and research of the collection. The Collections Manager is expected to be knowledgeable in long-term care and maintenance of the IZC, committed to growing the IZC, and active in conducting research using materials archived in the IZC. The Collections Manager reports to the Director of the NSRL.

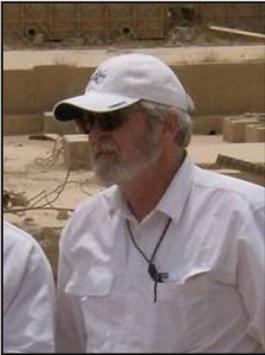
Candidates should have an M.A in Museum Sciences/Studies or M.S. in biology, entomology, or related field, and at least 18-36 months museum/laboratory/science/research work experience.

As details become available, they will be posted through the Careers webpage of Texas Tech University and on the NSRL website.

If interested and needing additional information, please contact NSRL Director Robert D. Bradley, robert.bradley@ttu.edu.

TTU FACULTY ASSOCIATES OF THE NATURAL SCIENCE RESEARCH LABORATORY

The following faculty at Texas Tech University have research programs that both contribute to and benefit from a working relationship with the Natural Science Research Laboratory. Graduate and undergraduate students of these faculty members, as well as those of the faculty Curators of the NSRL, conduct field-based research studies that result in growth of the NSRL collections and conduct laboratory-based research utilizing the resources of the NSRL to advance the sciences of mammalogy, ornithology, invertebrate zoology, wildlife ecology, and many other disciplines. The NSRL's strong history of field-based and organismal research, and continued commitment to such endeavors, set us apart from many other natural history programs.



Dr. Ron Chesser is a Professor of Biological Sciences. His research program focuses on assessing radioactive contamination, reconstructing flow of radioactive materials into the environment, and modeling the impacts and recovery of mammal populations affected by radiation. He has conducted research at Chernobyl, Ukraine, since 1992. He worked in Iraq for eight years (2005–2013) dismantling the former nuclear infrastructure, and he has contracted with the US Department of State, Department of Energy, International Atomic Energy Agency, Great Britain Ministry of Industry, US Civilian Research & Development Foundation, and the European Commission.

ron.chesser@ttu.edu

<http://www.faculty.biol.ttu.edu/chesser/homepage/>



Dr. Tigga Kingston is an Associate Professor of Biological Sciences. Her research and activities are dedicated to the conservation ecology of Paleotropical bats. She has been working on the conservation ecology of bats of Southeast Asia for more than 20 years, with projects in Malaysia, Indonesia, Myanmar, Philippines, and Vietnam. More recently, she has student projects and collaborations in Africa, specifically Nigeria, Kenya, and South Africa.

tigga.kingston@ttu.edu

<http://kingstonlab.org/>



Dr. Liam McGuire is an Assistant Professor of Biological Sciences. His research focuses on the ecology and physiology of bats and birds in situations of energy limitation (e.g., migration, hibernation) and the strategies these animals use to cope with environmental variation, often in the context of conservation issues. He takes an integrative approach using techniques ranging from molecular biology and biochemistry, to whole animal physiology, behavioral and movement ecology. Current research foci include the physiological ecology of bat migration, and the physiological ecology and pathophysiology of hibernating bats affected by white-nose syndrome, a devastating fungal disease responsible for killing millions of North American bats.

liam.mcguire@ttu.edu

<https://www.depts.ttu.edu/biology/people/Faculty/McGuire/>



Dr. David A. Ray is an Associate Professor of Biological Sciences. The Ray laboratory focuses on the study of genomes and genome evolution with an emphasis on transposable elements and their role in the diversification of species. Model organisms include bats, several other mammals, and crocodylians.

david.4.ray@gmail.com

<http://www.davidraylab.com/>



Dr. Brenda Rodgers is an Associate Professor of Biological Sciences. Her research centers on the impacts of radiation on small mammals, mechanisms of adaptation to low dose radiation in pregnant females and fetuses, and human health issues in contaminated environments. She has worked on mammal population impacts at Chernobyl, Ukraine, since 1997. She worked for eight years in Iraq evaluating human impacts in contaminated regions and training scientists on laboratory practices, and she has contracted with the US Department of Energy (Low-dose Program), US Department of State, and the Civilian Research & Development Foundation.

brenda.rodgers@ttu.edu

<http://www.depts.ttu.edu/biology/people/Faculty/Rodgers/>



Dr. Jorge Salazar-Bravo is an Associate Professor of Biological Sciences. His research revolves around two basic themes: developing and testing phylogenetic hypotheses for mammalian taxa at various hierarchical levels; and using first principles in ecology and evolution to understand the triggers for disease emergence. Research topics he has pursued, as represented in his publications, include: systematics, biogeography, evolution, and conservation of Neotropical mammals; the ecology and evolution of virus/host co-evolution; and the interplay between ecology and disease.

j.salazar-bravo@ttu.edu

<http://www.depts.ttu.edu/biology/people/Faculty/Salazar-Bravo/>



Dr. Richard Stevens is an Associate Professor of Natural Resources Management. He is a bat and rodent community ecologist, macroecologist, and biogeographer. His lab conducts collections-based ecological work in Paraguay, Colombia, Mojave Desert, and Texas. They also conduct morphometric studies to try to better understand the relationship between form and function in bats as well as how phenotypic variation contributes to large-scale patterns of biodiversity.

richard.stevens@ttu.edu

<http://www.myweb.ttu.edu/richstev/>



Looking for good students! Bradley in Davis Mountains, Texas.

A Message to Prospective Students:

Faculty and staff associated with the NSRL are very active in field- and specimen-based research. Our faculty and students have interests in mammalogy, ornithology, invertebrate zoology, molecular systematics, genomics, ecology, and museum science. Most of the undergraduate and graduate students that are affiliated with the NSRL receive degrees in the Department of Biological Sciences or the Department of Natural Resources Management. We

also have students who are part of the Museum Science program. Together, we have a strong core of faculty and undergraduate and graduate students, and we are always on the look-out for potential new students. If you are interested in pursuing a graduate degree or undergraduate research opportunities, please contact any of the faculty members highlighted in this newsletter.



PLEASE SUPPORT THE NSRL

Dear Former Students, Colleagues, and Friends:

In 2015, a fund-raising initiative for the NSRL was established. The NSRL Fund for Excellence is designed to help support the many collections activities of the NSRL. Our goal is to use these funds to establish a student curatorial position. This position would enable the NSRL to improve curatorial and collection management activities, as well as help support students with a professional interest in natural history collections. As this fund grows, we envision that we will be able to financially support multiple students.

Your contribution to the Natural Science Research Laboratory Fund for Excellence is very important to the future of the NSRL. With limited, and often declining, funding from state and federal sources, the NSRL needs your help to ensure our continued service to the academic and scientific communities. We appreciate your consideration in giving a tax deductible donation in support of the NSRL's operations and research. Many of you benefited from the resources provided by the NSRL, now we ask that you help the NSRL continue its quest to be among the premier natural history collections in the world.

Donations to the NSRL Fund for Excellence may be made through the Texas Tech Foundation, Inc. To donate by check, please make the check payable to Texas Tech Foundation, designate NSRL Fund for Excellence on the memo line, and mail to: Texas Tech University System, Financial Services, Box 45025, Lubbock, TX, 79409-5025. To give by phone, call toll free: 1-866-448-3888. To donate online, visit the website of TTU Institutional Advancement at <http://donate.give2tech.com/> and enter Natural Science Research Laboratory Fund for Excellence in the search box.

YOUR SUPPORT IS APPRECIATED! THANK YOU!

NSRL News is produced biannually by Lisa Bradley with assistance from the staff, research scientists, and graduate students of the NSRL. Please contact Lisa to request a hard copy or to submit comments or contributions for upcoming issues of *NSRL News*.

lisa.bradley@ttu.edu

806-834-4732

NSRL, Museum of Texas Tech University, Lubbock, TX 79409

