



2012-2013
ANNUAL REPORT

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Correction

Our 2011-12 Annual Report cover showed a speleothem reported as destroyed. It still exists; a similar nearby speleothem had been destroyed. For reasons like this, NCKRI archives cave photos as historical and scientific records. We appreciate your support in achieving these goals.

Cover Photos

Sinkhole damage has been in the news this year, but not all sinkholes are bad. On the front cover, Rainbow Springs, the 4th largest in Florida, rise from a submerged sinkhole as the source of the Rainbow River. On the back cover, the sinkhole entrance of Lost Creek Cave, Tennessee, is an important source of water into a local aquifer. Both photos by George Veni.



Vision and Values

The National Cave and Karst Research Institute (NCKRI) will be the world’s premier cave and karst research organization. NCKRI promotes and performs projects of national and international application, of the highest quality and integrity, through dedicated staff and partners.

Organization and Mission

NCKRI is a non-profit 501(c)(3) corporation. It was created by the US Congress in 1998 in partnership with the National Park Service, State of New Mexico, and the City of Carlsbad. Federal and state funding for NCKRI is administered by the New Mexico Institute of Mining and Technology (aka New Mexico Tech or NMT). Funds not produced by agreements through NMT are accepted directly by NCKRI.

NCKRI’s enabling legislation, the National Cave and Karst Research Institute Act of 1998, 16 U.S.C. §4310, identifies NCKRI’s mission as to:

- 1) further the science of speleology;
- 2) centralize and standardize speleological information;
- 3) foster interdisciplinary cooperation in cave and karst research programs;
- 4) promote public education;
- 5) promote national and international cooperation in protecting the environment for the benefit of cave and karst landforms; and
- 6) promote and develop environmentally sound and sustainable resource management practices.

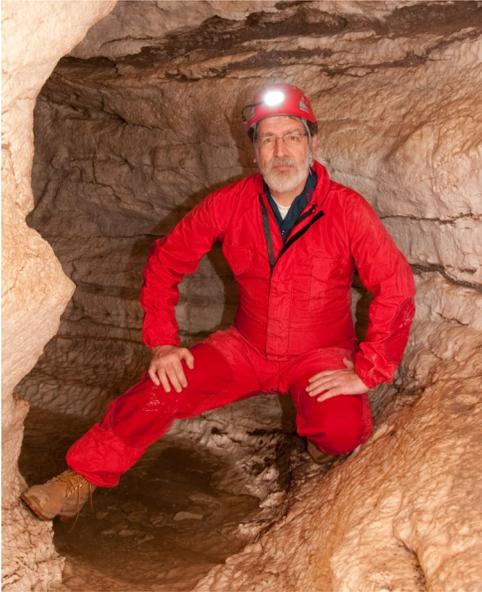
NCKRI Annual Report Series

NCKRI produced this publication as part of its annual reporting of activities. The reporting period covers NCKRI’s fiscal year, from 1 July to 30 June of the following year. Digital copies of this and previous reports are available for free at www.nckri.org.

NCKRI is a proud institute of:



EXECUTIVE DIRECTOR'S REPORT



Sinkholes have been in the news a lot this year. Sinkhole collapses claimed lives in Florida and China. Millions of dollars in damages and years of disrupted lives were tallied as the months rolled by. Yet sinkholes are natural features of karst terrains and not all sinkholes are alike. While some form overnight or over many months to hurt people and property, others form over thousands of years and cause no harm. Such sinkholes are often scientifically important and vital to replenishing groundwater in karst aquifers for human use.

This year was also the first that the Sinkhole Conference, more formally known as the *Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst*, was held under NCKRI's management. The purpose of this 29-year old conference series aligns well with NCKRI's goals to better understand karst phenomena, predict where problems might occur, prevent and repair them when they do occur, and help people to more wisely live in karst while benefiting from cave and karst resources.

The Sinkhole Conference developed in response to a catastrophic 1981 collapse in Winter Park, Florida. Some media sources have wondered why so many sinkholes seemed to have formed this year. I know that if not for the previous dozen Sinkhole Conferences, the collapses would have been greater in number, size, and damage. The Sinkhole Conference series was the first and perhaps most important in a number of events that improved our understanding of sinkholes, leading to improved regulations, construction, and engineering methods that have reduced sinkhole occurrence and damage.

Certainly there is a lot more to learn about sinkholes and a need for regulatory policies to improve. I'm proud that NCKRI now includes the Sinkhole Conference as part of its efforts to better manage karst, and to educate and protect the public in regard to this unique terrain. An expert team of karst scientists is working with NCKRI on the Sinkhole Conference, but with roughly 20% of the US being karst, more help is greatly needed. I invite you to contact us at NCKRI and help however you can: donations, information, research partnerships, memberships, whatever you can do. Sinkholes cannot be avoided, but with your help NCKRI will continue to work on making life on karst as safe and beneficial as possible.

A handwritten signature in black ink that reads "G. Veni".

George Veni, Ph.D.

NCKRI RESEARCH

San Solomon Spring Dye Trace

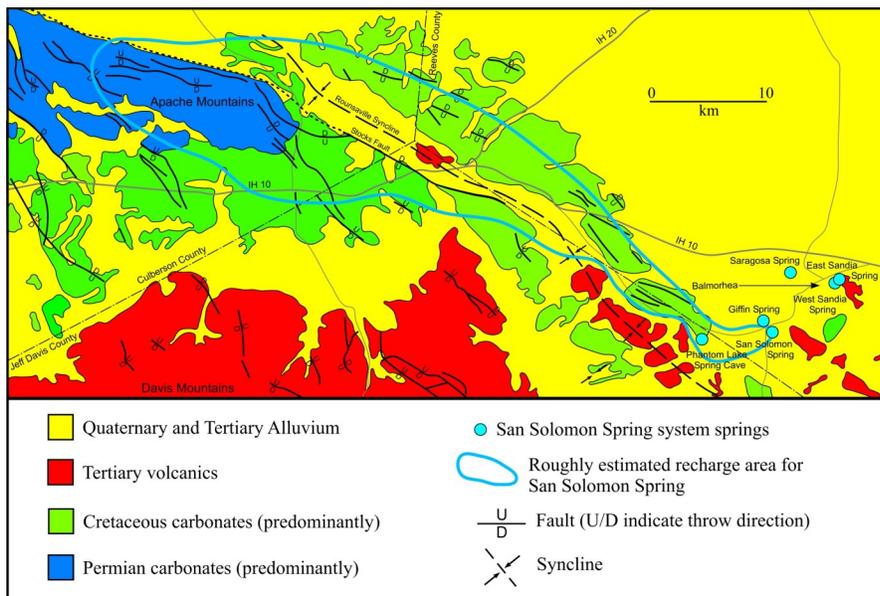
During the first quarter of 2013, Drs. Land and Veni conducted NCKRI's first dye trace investigation. It was based in west Texas, in Jeff Davis and Reeves counties, to determine if a hydrologic connection exists between Phantom Lake Spring Cave and the San Solomon Spring group.

Located at the western edge of the Edwards Plateau, the cave is the western most of the six springs of the San Solomon group, which are distributed over a 13-km long northeast-southwest trending area that extends across the town of Balmorhea. San Solomon Spring is located in the middle of the group and is the largest spring with a mean flow of 850 L/s. The spring pool is the main attraction at Balmorhea State Park.

The San Solomon Spring group flows from the Cretaceous age rocks of the Edwards-Trinity Aquifer. Earlier studies suggest that much of the water is recharged in the older Permian age rocks of the Apache Mountains, 40-80 km to the northwest.

While these springs have been used by Native Americans since pre-historic time, in 1986 the Texas Water Commission proposed the springs' region as part of a "critical area" that "is experiencing or is expected to have ground-water problems resulting from ground-water overdrafts from an aquifer." Spring records show general declines in flow since 1945 when irrigation pumping began to greatly increase in the area.

The decrease in discharge was greatest at Phantom Lake Spring Cave, which the US Bureau of Reclamation purchased and built a refugium canal and pool in 1993 to protect the populations of two endangered species of fish that depend on its flow. In 1999, flow ceased from the cave's entrance and from May 2000 to the present, the US Bureau of Reclamation has pumped water from in-



Simplified hydrogeologic map of the San Solomon Spring system region (based on Barnes, 1975, 1976, 1979, 1982; LaFave and Sharp, 1987).

side the cave to the refugium pool, which flows over a small dam back into the cave, to sustain the species at that location.

The water in the cave rises from submerged passages. Cave divers of the ADM Exploration Foundation have surveyed about 2.4 km of underwater passages upstream of the entrance to a depth of 140.8 m, making it the deepest underwater cave in the US. Although water no longer flows from its entrance, it continues to flow into passages that extend downward and have been explored about 500 m southeast of the cave's entrance. The water in this passage was suspected as the main source of water for the other five San Solomon springs. The tracer study was designed to determine if this was true.

In January 2013, Drs. Land and Veni injected uranine dye into Phantom Lake Spring Cave. The dye arrived less than six days later at San Solomon Spring at Balmorhea State Park about 6 km east of the cave entrance, demonstrating a mean flow rate greater than 1,000 meters/day, and clearly demonstrating the karstic

nature of the aquifer system. Dye was not detected at any of the other springs or at any of four monitored wells.

The results of the tracer study demonstrate conclusively that the cave is the principal source of water for San Solomon Spring. A careful review of the dye concentrations indicate little inflow of other water between the dye injection point in the cave stream and San Solomon Spring.

A full report is being prepared and will serve as the foundation for future tracer studies in that area to better define and help best manage its crucial water resources.

NCKRI conducted this project in cooperation with and the assistance of the ADM Exploration Foundation, City of Balmorhea, Madera Valley Water Supply Corporation, Reeves County Water Improvement District No. 1, Texas Parks and Wildlife Department, The Nature Conservancy, US Bureau of Reclamation, private well and spring owners, and especially the Edwards Aquifer Authority which provided critical supplies, equipment, and analyses.

NCKRI Bat Roost

“If you build it, they will come.” NCKRI believes this will be true for its bat roost. NCKRI Headquarters is the only building in the world designed to include a home for bats. The roost has space for an estimated 5,000-7,500 bats, but since it was finished in late 2010, no bats have moved in. What’s the problem?

Bat Conservation International (BCI) helped design the roost to be an ideal home for bats. BCI’s statistics show that 2-5 years are usually needed for bats to find a new roost, so the lack of bats as of the end of June 2013 isn’t a surprise. Motion-activated infrared cameras have been watching for bats since September 2011, so we know that no bats have discovered the roost during the past 22 months.

While the NCKRI roost is within the normal waiting period for discovery, something may also be keeping bats away. Since the time the roost was built, New Mexico has suffered with what is now seen as its worst drought on record. With low rainfall, far fewer insects are in the area. Flying insects are what most bats in the area eat and with less food, the Carlsbad area has fewer bats. With low bat populations, fewer bats are looking for a new home.

As we wait for rain and bats, we’ve found two positive sides to the drought. First, our Bat Roost Research Committee, comprised of bat biologists Debbie Buecher, Jim Ken-

nedly, and Ronnie Sidner, were able to complete the first version of NCKRI’s bat roost research plan before any bats move in. Second, our dataloggers are collecting important information on conditions in the roost. This will be useful in better understanding roost conditions after it is occupied.

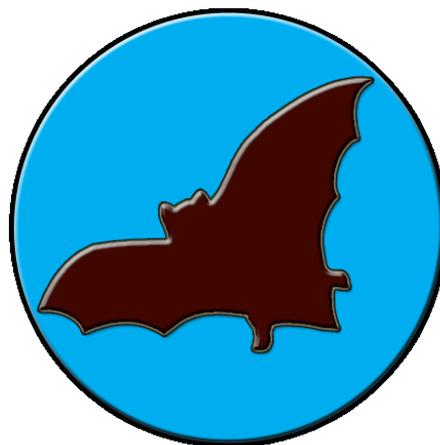
Once the roost is occupied, you will be able to watch the bats on our website and in one of our future museum exhibits!

If you would like to support NCKRI’s bat roost research, join our Adopt-A-Bat program. Adopting a bat costs only \$25 and includes a Certificate of Adoption, educational information about bats and our bat roost, and your very own “Barty the Bat” stuffed animal. All proceeds go to maintenance and equipment needed for the bat roost. We are also looking to expand our monitoring program with more and better equipment. For more information on how to help or to adopt a bat, go to www.nckri.org or call 575-628-2702.

Naica Cave

Dr. Penny Boston in collaboration with Dr. Diana Northup and Michael Spilde, both from the University of New Mexico in Albuquerque, and Cameron McMillan, Northern Arizona University, Flagstaff, continue to analyze materials collected during the 2008 and 2009 Naica expeditions to Chihuahua, Mexico.

Based on analyses of DNA, the nearest relatives to microorganisms found in this remarkable system include microbes from other caves elsewhere in the world, volcanic soils, heavy metal environments, and other unique settings. The specific, unusual properties of the strains isolated from the system include extraordinary resistance to highly osmotic fluids, resistance to high temperatures, high salinity, and high metal contents.



Bureau of Land Management Cave Assistance Agreement

The Fort Stanton Cave/Snowy River Passage project continues. NCKRI Scholar Daisy Morgan and Dr. Penny Boston have developed methods to separate and analyze the mud deposits in Fort Stanton Cave, New Mexico, for biological and climate signal data. To identify biological fragments found in cave muds, they are developing a comprehensive atlas of plant crystals (phyloliths) and diatoms (freshwater silica shelled algae) viewed in both optical and electron micrographs, energy dispersive X-ray spectra, and X-ray diffraction patterns. NCKRI’s geophysical work at the cave is described on page 5.

National Park Service Karst Resources

In April, 2013 work resumed on a survey of karst research, management and educational resources within the US National Park Service (NPS). Dr. Lewis Land is the lead investigator on this NPS-funded project, which includes sending a questionnaire about karst and pseudokarst resources to all National Park units identified as having the potential for such caves and features within their boundaries. Identification of these park units is based in part on GIS data derived from the US Geological Survey’s National Karst Map project. June 24 was the deadline for survey responses, after which NCKRI staff will analyze the results.



Photo by NCKRI Staff

Tucked into a modified eave, the NCKRI roost waits for its first bats to come visit.

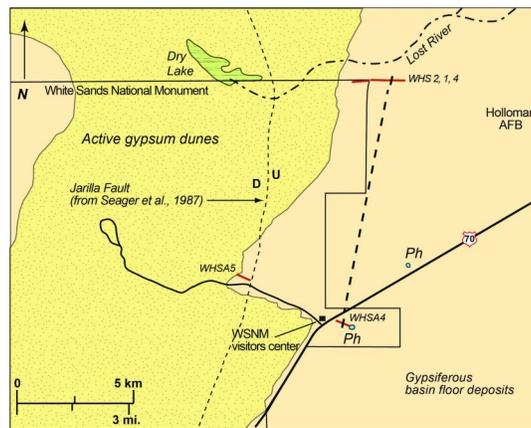
Geophysical Investigations

During fiscal year 2012-2013, NCKRI continued its use of electrical resistivity surveys to investigate a variety of karst-related phenomena. This work makes use of the Institute's AGI SuperSting R8/IP™ resistivity equipment and Topcon GR3 global positioning system. Resistivity profiles collected with the SuperSting equipment package illustrate vertical and lateral variations in subsurface resistivity, and are strongly affected by the presence of air or water-filled conduits. The resistivity method is thus well-suited for investigations of karst phenomena.

White Sands National Monument

In August 2012, Dr. Land spent five days conducting electrical resistivity surveys at White Sands National Monument (WSNM) in the Tularosa Basin, assisted by colleagues with the New Mexico Bureau of Geology and Mineral Resources (NMBGMR). The specific objective of these surveys was to more precisely locate the Jarilla Fault.

This basin-scale fault has no surface expression but trends from south to north beneath WSNM and the White Sands Missile Range (WSMR). The Jarilla Fault may play an important role in controlling deep groundwater flow paths in Paleozoic carbonate aquifers that underlie several hundred meters of Tertiary basin fill, including the white gypsum sands. The position of the fault is only roughly known. It is based primarily on airborne gravity surveys conducted several decades ago.



White Sands National Monument study area. Position of Jarilla Fault is derived from geologic map by Seager et al. (1987) and gravity data from Healy et al. (1978). Ph = Permian Hueco Limestone outcrop. Red lines show locations of ER surveys conducted in 2011 and 2012. Wide dashed line shows possible location of Jarilla Fault based on ER data.

Resistivity surveys conducted during the previous fiscal year successfully imaged a fault zone adjacent to a bedrock outcrop, suggesting that the Jarilla Fault probably occurs several kilometers farther east than indicated on existing surface geologic maps. Results of the August 2012 surveys indicate that resistivity survey lines also intersect the Jarilla Fault in an area ~10 km northeast of the electrical resistivity surveys conducted during the previous year's investigations.

This work is funded by the National Park Service. It is part of a larger effort by the NMBGMR to characterize the groundwater hydrologic systems within WSNM, and determine the relationship between groundwater and surface water systems in that part of the Tularosa Basin.

Gypsite Geophysics

In October 2012, Intrepid Potash Company discovered a small cave while excavating a pipeline trench in eastern Eddy County, New Mexico. The cave extended about 1 m below ground level and then opened into a room approximately 8 m long by 5 m wide, reaching a maximum depth of about 10 m. NCKRI was contracted to conduct a series of electrical resistivity surveys of the site to evaluate its stability for further trenching and related activities. The work was led by Dr. Lewis Land and Dianne Joop, with assistance from Intrepid personnel.

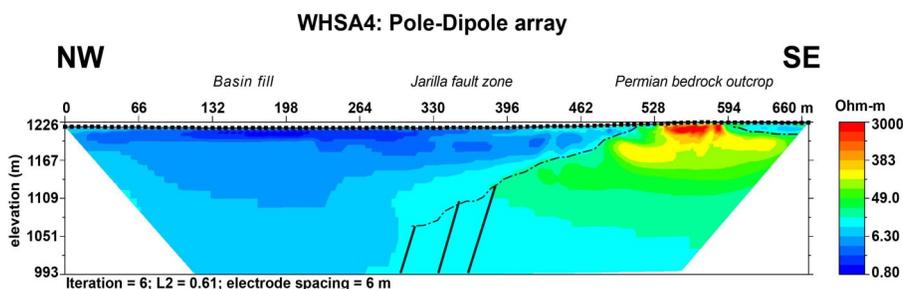
The surveys successfully imaged the cave and did not find evidence of other large or potentially unstable significant voids in the studied area. The complete results were published and are available in NCKRI's Report of Investigations 3.

While NCKRI was happy to assist Intrepid Potash Company in maintaining its excellent safety record, NCKRI's special interest in this project was that the cave was formed entirely in gypsite (compacted gypsiferous soil), not bedrock. NCKRI's records suggest this may be the first electrical resistivity survey in gypsite. This survey will be an important addition to NCKRI's geophysical database for future comparative study.

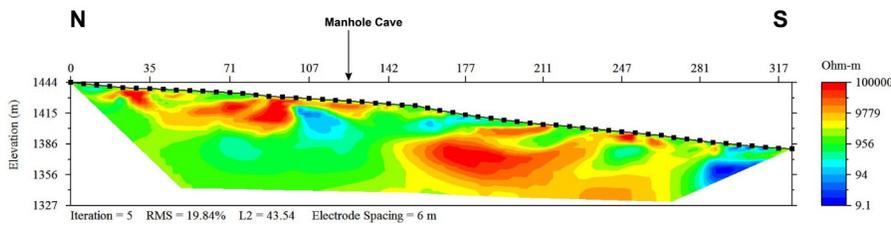
Manhole Cave

During the winter of 2012-13 Drs. Land and Veni led six electrical resistivity surveys of Manhole Cave in the Guadalupe Mountains, New Mexico, with the help of many excellent volunteers. Manhole is a roughly 25-m deep pit in the Seven Rivers Embayment of the Guadalupe, and is thought by many cavers to be a second entrance to Lechuguilla Cave. Digging in the cave has been ongoing for several years, following airflow through cemented breakdown. Conducting electrical resistivity surveys in the area was quite challenging because of the rugged terrain and desert vegetation.

Preliminary results suggest that a substantial void is present in the subsurface a few tens of meters below



White Sands resistivity profile. Solid lines are the approximate location of the Jarilla fault zone. Dashed line is the unconformable contact between bedrock and overlying basin fill.



Electrical resistivity profile Manhole Cave, Guadalupe Mountains, New Mexico.

and to the south of the dig. Dr. Land is developing a three-dimensional model of the survey results using EarthImager 3D software, and will present the results in a report to the US Bureau of Land Management. NCKRI staff are preparing to conduct a microgravity survey of Manhole Cave in late summer of 2013 to combine and compare with the ER survey to better interpret the data.

Microgravity Research

During the second quarter in 2013, Dr. Land began working with a Scintrex CG-5 gravity meter that NCKRI has on extended loan from the Hoffman Environmental Research Institute at Western Kentucky University. In return for access to the gravity meter, Dr. Land will provide training for WKU staff on use of the instrument when he returns it to them in October 2013.

To date, microgravity surveys have been conducted over Parks Ranch Cave and additional surveys are planned for Fort Stanton Cave and Manhole Cave, all in New Mexico. These surveys will occur along electrical resistivity surveys previously conducted at those sites.



Photo by George Veni

Entrance to Manhole Cave, Guadalupe Mountains, New Mexico.

Karst Information Portal (KIP)

The work to complete adding the National Speleological Society's materials to the KIP collections has concluded (with many thanks to Alex Sproul!). KIP now also has the full run of *The Texas Caver* (two years were missing). Professor Bogdan Onac of the University of South Florida (USF) obtained permission for KIP to host all issues of the journal *Theoretical & Applied Karstology*. This necessitates some digitization of issues currently only accessible in print.

The migration of KIP to a new platform (Drupal 7.0) was completed. A mapping service has been implemented and is accessible when users browse the collection by cave name (<http://www.karstportal.org/browse>). In 2012, USF hired a full time Geospatial Analyst to contribute to this mapping and other projects associated with data management and open-access publishing.

When users now browse the collection by cave name, spring name, karst formation name, and soon, sink-hole name or designation, they retrieve a record that provides a Google-style map locating the feature, a description of the feature, and a list of resources in KIP that contain content concerning the feature.

This is the first of four phases of development that will conclude with a geographic interface through which KIP users can access KIP's virtual library. It is a complicated process and innovative plan with no known model to draw from.

To protect site locations, we are limiting the geospatial precision of feature locations to that which is either: 1) publicly available via a web search in the case where locations are described, or 2) two decimal places when locations are not

publicly accessible (e.g. 30.26, -97.77 versus 30.2639, -97.7781).

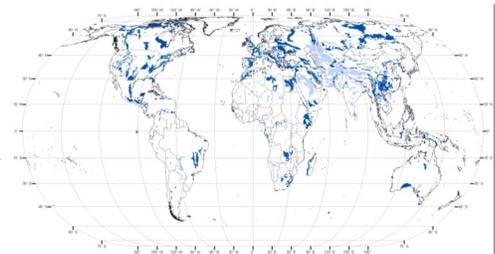
In addition to deploying the GIS functionality, we are working with colleagues from the US Geological Survey, The Nature Conservancy, and the University of Arkansas to repair and implement an online geospatial database and mapping service called the "Karst Regions of the World" (KROW). The brainchild of Emily Hollingsworth (formerly a graduate student at the University of Arkansas, working under Dr. Van Brahana), work on KROW is now proceeding.

In addition to these upgrades and new projects, the collection of materials in KIP's open access library has grown to over 6,700 items and use of KIP continues to increase.

Mapping the Worlds' Karst

How much of the world is karst? Mapping efforts over the years have estimated it at 12-25%. NCKRI is now part of an international team, led by the Karlsruhe Institute of Technology in Germany, to develop a new, highly detailed, GIS-based World Karst Map.

The International Association of Hydrogeologists is funding the karst map, which is being assembled from digital national geologic maps and other international karst maps such as the KROW project described above in the KIP report. The mapping team is also collecting information on major caves, karst springs, and wells; NCKRI is taking the lead on North America and the Caribbean. A paper map will be produced from this project, which will also be digitally available in a form that can be easily updated.



Map of the world's karst areas (Williams and Fong, 2010).

The Mayan Maze: Actun Kaua

Actun (Mayan for “cave”) Kaua is located under the town of Kaua in north-central Yucatan, Mexico. It is a 10.4-km long complex maze, with many of its larger passages containing potsherds and drawings from the ancient Maya. Parts of the maze contain more than 1 km of passage per 100 m² area—the highest density of passages known in the world. Dr. Veni was part of the team that was surveying and studying this cave, but work on the project was put on hold since his last trip in January 2003.

While in Cancun, Mexico, teaching a workshop in September 2012, Dr. Veni returned to the cave with members of Grupo Espeleológico Ajau from the city of Merida. NCKRI sponsored some of the expedition costs with funds earned from the workshop. About 100 m of survey were added to the cave during their short visit. The main goals of the trip were to reestablish ties with the town mayor and police, who are happy to see continued work at the cave, and assess the cave and current local logistics for future, more substantial study when greater funding and sponsorship are available.



Photo by George Veni
The mayor of Kaua and Dr. Veni, flanked by members of Grupo Espeleológico Ajau.

Many questions remain about Actun Kaua. Its full extent is not known. Its mode of origin is unusual, and potentially geologically unique. The cave’s use by the ancient Maya and the meaning of the drawings is uncertain. The known limits of ancient Maya activity extend to near the explored limits of the cave. The ancient Maya have proven capable of exploring long distances into caves. They could have penetrated considerably further, which additional exploration and study will determine.



Dozens of Mayan drawings cover many of the walls in Actun Kaua.

Photo by George Veni

Tularosa Basin Hydrologic Study

Last year Dr. Land published a map of the regional water table in the southern Sacramento Mountains, New Mexico. Extending that mapping farther west, this year Dr. Land completed a map of the water table on the west flank of the mountains and eastern Tularosa Basin, in collaboration with colleagues from the New Mexico Bureau of Geology and Mineral Resources (NMBGMR). The hydrologic setting in this area is much more complex than in the southern Sacramentos, with multiple karstic and non-karstic aquifers in a variety of rock types including volcanics. That map will be published as an NMBGMR Open File Report.

NASA Infrared Instrument Development

Dr. Boston completed the fourth and final year of this project, yielding a unique, tunable acousto-optical laser spectrometer. The instrument was lab-tested and integrated with a time-of-flight mass spectrometer at Goddard Spaceflight Center in late 2012. Plans for deployment of the small field unit are underway in caves in New Mexico in the summer of 2013. She collaborated with Dr. Nancy Chanover and Dr. Dave Voelz at New Mexico State University, Las Cruces.

NASA Minority Engagement Project

Dr. Boston completed the first year of another collaboration with Dr. Nancy Chanover at New Mexico State University, Las Cruces, and Scott Halliday at Navajo Technical College (NTC), Crownpoint, New Mexico, to produce the fully workable field unit of the acousto-optical spectrometer described above. Additionally, they are producing physical models of cave wall textures using LiDAR (laser) mapping and rapid-prototyping technology at NTC. They are using the physical models to investigate microbiological, mineralogical, and micrometeorological properties of cave walls at small scales.

EDUCATION PROGRAM

Environmental Education

This year NCKRI's Education Director, Dianne Joop, conducted a series of Environmental Education presentations for our local partners: Carlsbad Public Library, Nana's Fire and Safety School, and Carlsbad Caverns National Park. Three hundred and eleven participants crawled their way through manmade caves, practiced echolocation, modeled groundwater flow, and crafted bats and water cycle bracelets.



The summer education program was made possible through a grant provided by Outdoor Nation.



NCKRI Photo

Dianne Joop demonstrates the karst ground-water model.

Interpretation

Dianne Joop conducted a week-long program for Sinkhole Conference guests, providing interpretive tours to local cultural and natural resources including Sitting Bull Falls USFS recreation site, Bottomless Lakes State Park, UFO Museum, Carlsbad Museum & Art Center, and Carlsbad Caverns National Park.



NCKRI Photo

Suzanna Langowski administers the groundwater conservation oath.

International Workshops

Dr. Veni travelled to Cancun, Mexico, to teach the workshop, *Environmental Impacts and Management of Karst Systems*. The workshop was hosted by Los Amigos de Sian Ka'an and sponsored by multiple organizations. Over 100 participants joined the two-day event, including governmental, private, and non-profit geologists, biologists, environmental scientists,

and show cave managers. The workshop also included 10 papers by regional experts and a roundtable discussion on the karst hydrogeology and management of the Yucatan aquifer.



National Cave and Karst Management Symposium 2013 Logo

Web Development and Graphic Design

The focus for the Education Program this year was web development and graphic design, where Dianne Joop put her creative talents to use! She developed websites, graphics, and other materials for conferences being hosted by NCKRI.



Photo by George Veni

Registration at NCKRI's Cancun karst management workshop.

STUDENT ACTIVITIES

Cave and Karst Studies Program at NMT

Cave and Karst Studies at New Mexico Tech (NMT) is NCKRI's academic program and taught through NMT's Earth and Environmental Sciences Department. A variety of regular courses and special topics are taught by Dr. Penelope Boston on a rotating 2-year frequency, several in collaboration with other faculty.

Researchers and students of the Cave and Karst Studies program are engaged in excellent and exciting research with new and continuing projects, setting a very high academic and research standard at NMT.

Student Projects

Speleothems in Mexico

Laura Rosales Lagarde, former PhD student, graduated in fall 2012, and is currently doing a postdoctoral fellowship with Dr. M. Lachniet, University of Nevada, Las Vegas, working on climate signals in speleothems in Mexican caves.

Ice Caves in Antarctica

Aaron Curtis, PhD Student, Geology, is in his final year of studying ice samples from Antarctica obtained during previous field seasons as part of his work on the physical and biological dynamics of fumarolic ice caves and towers on Erebus Volcano. He will be returning to Antarctica for a fifth and final field season in November 2013.

Fort Stanton Cave

Kristina Daisy Morgan-Edel, MS Student, Hydrology, is on track to graduate in December 2013. She has developed cutting edge procedures to search for biological materials and climatically significant geochemical signals from surface sources from flooding events in Snowy River, Fort Stanton Cave, New Mexico. This cave is managed by the Bureau of



Land Management. These data are being compared to cave muds from US Forest Service caves in the Guadalupe Mountains of New Mexico.

El Malpais Lava Tubes

Hilary Kelly, MS/PhD Student, Geology, completed her first year at New Mexico Tech. She completed a five week intensive summer field course, *Geobiology 2013*, sponsored by the Agouron Institute and the Moore Foundation. Kelly's research centers on a pilot field study in collaboration with Navajo Technical College. She is using 3-dimensional replicas of lava tube walls, both with and without significant visible microbial/mineral deposits, in order to study them in the laboratory. The field sites are at El Malpais National Monument, Grants, New Mexico, which is administered by the National Park Service, and at the Pisgah

Lavafield lava tubes in the Mojave Desert, California, which is managed by the Bureau of Land Management.

Guadalupe Mountains Caves

Sam Rochelle, BS student, Physics Major, Earth Science Minor, continues work on a research project in Black Cave, Hidden Cave, and Cottonwood Cave in the Guadalupe Mountains of New Mexico. Sam is characterizing distinctive dark coatings and banding in speleothems and on surfaces in Black Cave and using the other caves as control cases. He is also conducting laboratory tests of some of the basic transport mechanisms that might bring black particulate materials into these caves. He is attempting to explain how such coloration came to be present and what role it may have played in the history of these caves, which are managed by the US Forest Service.

NCKRI's Advancement Office was established to position, support, and advance NCKRI's mission through membership, fundraising, news and communication, marketing, community relations, and special events.

In August of 2012, Suzanna Langowski was brought on as NCKRI's new Advancement Director. Suzanna came to NCKRI after several years of experience building resource management programs for large land holding agencies throughout the USA. Below are reports of some of her activities during her first year at NCKRI. In addition, she has focused on completing the administrative foundation necessary for NCKRI to have a fully effective advancement program.

NCKRI Receives Grant from the City of Carlsbad for State-of-the-Art AV System

Like many cities, Carlsbad collects an occupancy tax of 5% on "gross taxable rent" from hotels, motels, or other premises used for lodging of tourists. Businesses and organizations may apply for Lodgers Tax funds in support of special events, advertising, and promoting tourist-related attractions and facilities.

NCKRI applied for and received a \$25,949.35 grant from the City of Carlsbad for a professional audio-visual system for use in the Headquarters' professional conference space. The system includes two ceiling mounted projectors (one is a 3D projector), sound system, BluRay player with WiFi and hard-wired Internet access, high-definition wall-mounted projection screens in each room that are suitable for both 2D and 3D images, and a few dozen professional grade 3D glasses. In addition to use during conferences and meetings, the new system allows projection of 3D movies for entertainment and will support NCKRI's educational programming.



Membership

NCKRI's Annual Membership program is offered to all interested people who want to support NCKRI activities. You can join online at www.nckri.org or call the Advancement Office at 575-628-2702.

When you become a member, you will receive a quarterly digital newsletter, reduced rates on special presentations, classes, lectures, and facility rentals, as well as discounts in NCKRI's Museum Store.

Meeting and Conference Rental Space

With the installation of the new AV system, NCKRI's conference space is now fully ready to host conferences, meetings, training, and other activities. During the past year it has been increasingly rented by a wide variety of organizations looking for a versatile and professional meeting facility in the heart of Carlsbad. NCKRI also rents for parties and other fun and less formal events. All funds from the rentals go to support and build NCKRI and its programs. For more information, contact us at info@nckri.org or by calling 575-887-5518.

Facebook

Follow us on Facebook at <https://www.facebook.com/NCKRI?ref=hl> and keep up-to-date with all kinds of cave and karst news!

Adopt-A-Bat

NCKRI's Adopt-A-Bat program continues to grow and helps raise funds for the maintenance and equipment needed for our bat roost. NCKRI's Headquarters is the first building in the world with a bat roost intentionally incorporated into its design! Once it is occupied, you will be able to watch the bats on our website and in one of our future museum exhibits! Each adoption is only \$25 and includes a Certificate of Adoption, educational information about bats and our bat roost, and your very own "Barty the Bat". Sorry, you do not receive a live bat. For more information and to adopt a bat, go to www.nckri.org or call us at 575-628-2702.

Additional information about NCKRI's bat roost and its research program are in an article on page 3.



Partnering for a Strong Institute

NCKRI recognizes four levels of partnership and uses their descriptions below in defining its relationships with NCKRI partners:

Founding Partners

NCKRI's Founding Partners played a crucial role in the creation of the Institute and continue to serve as major supporting partners. Each Founding Partner maintains one permanent position on NCKRI's Board of Directors:

City of Carlsbad
New Mexico Institute of Mining
and Technology
US National Park Service

Institutional Partners

Organizations with formally defined mutually supportive relationships with NCKRI through Memoranda of Agreement, Memoranda of Understanding, contracts, or other written and signed agreements that are in effect for periods of at least one year and which define each party's specific roles and responsibilities:

American Geosciences Institute
Emil Racovita Institute of Speleology
Geological Society of America
Hoffman Environmental Research Institute/Western Kentucky University
Instituto do Carste
International Academy of Karst Sciences
International Union of Speleology
Karst Research Institute
Ukrainian Institute of Speleology and Karstology
US Forest Service
University of New Mexico
University of South Florida

NCKRI Affiliates

Organizations that have demonstrated meaningful support for NCKRI and its goals, or their intent to do so, but without a formal defining agreement. NCKRI Affiliates are approved by the NCKRI Board of Directors. NCKRI and its Affiliates exchange news and information as available, and they seek to coordinate and/or cooperate with each other in projects and activities. Each organization below may also extend other benefits according to their internal rules and abilities:

ADM Exploration Foundation
Bat Conservation International
Carlsbad Municipal Schools
Edwards Aquifer Authority
Fort Stanton Cave Study Project
Karst Waters Institute
National Speleological Society
National Aeronautics and Space Administration
New Mexico Bureau of Geology and Mineral Resources
US Bureau of Land Management
US Fish and Wildlife Service
US Geological Survey

NCKRI Members

Individuals and organizations that have paid annual dues to NCKRI and receive the rights and benefits described in Section III of the most current version of NCKRI's Bylaws, and as elaborated on in the most current version of associated membership documents found at www.nckri.org.

NCKRI Volunteer Program

Many of our programs and projects rely on the help of our fantastic volunteers. We would like to thank the following individuals for supporting NCKRI through their volunteer efforts:

Bonny Armstrong
Tom Bemis
John Burke
John W. Burke
Pam Cox
Matt Dollar
Jennifer Foote
Clay Gates
Andrea Goodbar
Andrew Goodbar
Jim Goodbar
Larry Henderson
Aubrey Jenson
Mark Joop
Chase Kicker
Dwayne Kicker
Tom Langowski
Sean Lewis
Santana McPherson-Ward
Larry Pardue
Michael Queen
Aaron Stockton
Jason Walz
Tami Walz

Online Shopping/Support

Please help raise funds and support for NCKRI by searching the Internet and shopping online through www.goodsearch.com and www.goodshop.com. Register NCKRI as the organization you support, and each GoodSearch will result in a small donation to NCKRI and a percentage of your GoodShop purchases will automatically go to NCKRI at no extra expense or hassle for you. GoodShop also has many

coupons and bargains that can save you money!

Giving to the Future of NCKRI

Private gifts support the mission of the National Cave and Karst Research Institute. Your contributions enhance programs, provide for excellence in staff, and support research programs. Thank you for your generosity and making NCKRI a priority in your charitable giving choices!

Many Ways to Give

At the National Cave and Karst Research Institute, every gift makes a big difference. Through **Annual Giving**, donors and friends support the areas of greatest need. The annual fund is the cornerstone of our fundraising program, and is used to support scholarships, equipment, facilities, research, and exhibit development. By making gifts, our supporters demonstrate their regard for the National Cave and Karst Research Institute and its mission.

Give Online: The simplest way to give. Visit www.nckri.org to make your gift.

Give by telephone with a credit card: Call our Advancement Office at 575-628-2702 and we will assist you in making your gift.

Give through the mail: Use the contribution envelope included in your printed Annual Report to make your gift, or send it to us at, National Cave and Karst Research Institute, 400-1 Cascades Avenue, Carlsbad, NM 88220-6215.

Legacy Covers

NCKRI's Legacy Covers are donors who have chosen to make a planned or deferred gift through their estate planning that will have an everlasting impact on the organization. Planned or deferred gifts include: bequest through a will, charitable gift annuity, charitable remainder trust, charitable lead trust, and gift of life insurance, real estate or other assets.

Gifts such as this not only help NCKRI, but also help provide the

donor with additional income, convert low income assets to higher income assets, help care for your surviving family members, avoid long-term capital gains tax, reduce your estate taxes, and generate income tax deductions.

The NCKRI Advancement staff will work with you in arranging proper forms or recognition that reflects your personal gift's purpose and your preferences. Your gift may also be given anonymously. For tax purposes, the National Cave and Karst Research Institute is a 501(c)(3) with a tax-exempt ID: 42-1741207. The National Cave and Karst Research Institute has not retained any professional solicitor and 100% of each contribution is received directly by NCKRI. For more information on leaving a legacy, please call our Advancement Office at 575-628-2702.

Scholarships Change Lives

Scholarship support is one of the most important ways to impact the lives of students. There are several ways to support student scholarships at the National Cave and Karst Research Institute:

- Through NCKRI's Annual Giving program
- By making a gift to an existing scholarship fund
- By creating a new scholarship fund
- By donating to NCKRI's Endowment Fund that is managed and invested by the New Mexico Institute of Mining and Technology's NMT Foundation

You can designate your program of choice and name the scholarship fund in memory or honor of someone. We would be happy to talk with you about your ideas, so please call our Advancement Office at 575-628-2702.

Giving Recognition Annual Giving

Our Annual Giving Program recognizes those individuals and corporations who made gifts or pledges during FY 2012-2013 in support of NCKRI programs:

Albertson's Market
 Dr. E. Calvin Alexander
 Connie Campbell-Brashear
 Dr. Robert Brinkmann
 Jessica Buckles
 Lynda Burd
 Carlsbad Community Foundation
 Richard Cervantes
 City of Carlsbad
 Sandra Cosand
 Harvey DuChene
 Earth and Water Resources, LLC
 Edwards Aquifer Authority
 Edwards Aquifer/Barton Springs Conservation District
 Flight 33 Productions
 Dr. Derek Ford
 Garden Mart
 GoodSearch.com
 Dr. Ronald Green
 Illinois State Geological Survey
 Larry and Signe Henderson
 Katrina Henry
 Intrepid Potash
 Johanna Kovarick
 Scotia Kurowski
 Suzanna Langowski
 David Lester
 Santana McPherson-Ward
 Hazel and Doug Medville
 Scott Nyhof
 Outdoor Nation

Dale Pate and Paula Bauer
 PELA GeoEnvironmental
 Dr. Michael Queen
 Leonard Runner
 Geary Schindel
 Dr. Lindsey Schuyler
 Dr. Patricia Seiser
 Larry Shore
 Susan Lee D. Stevens
 Heather Tuček
 Dr. George Veni
 WalMart
 David Weary
 Estate of William L. Wilson

Gifts of Knowledge

It is always difficult to distinguish certain gifts among the many, but this year's contributions to NCKRI's library deserve special mention. Generous gifts were made by Dr. Derek Ford, Dr. Patricia Seiser, Lee Stevens, and the Estate of William L. Wilson. The Ford and Wilson collections were especially large and filled important gaps in the international and hydrogeological sections of NCKRI's growing library. With the Wilson collection coming from Florida, it was first scanned into the Karst Information Portal at the University of South Florida.

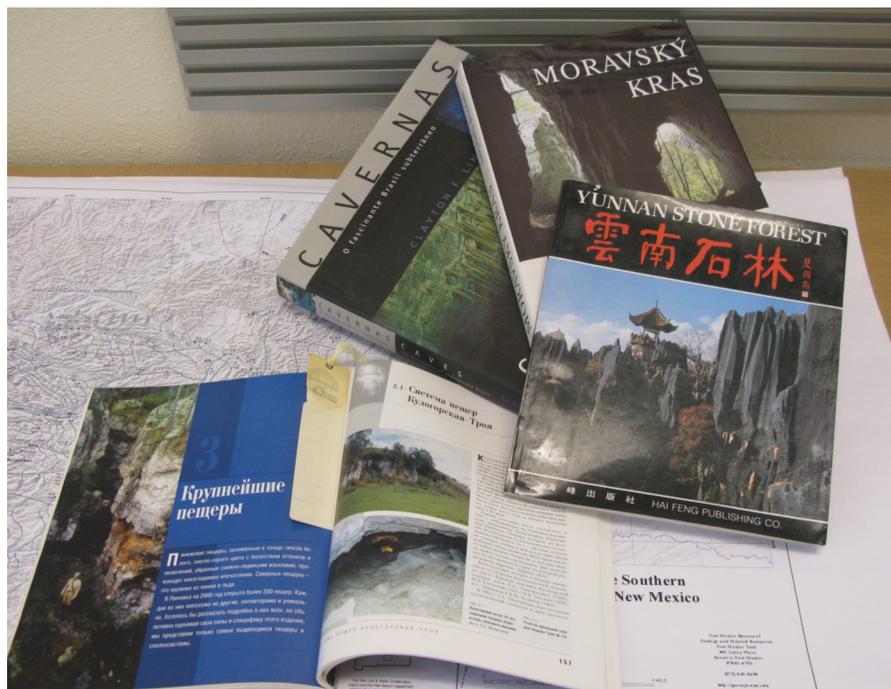


Photo by Suzanna Langowski
 An international sampling of two bookcases of karst literature donated by Dr. Derek Ford.

CONFERENCES AND MEETINGS AT NCKRI

Workshops, symposia, meetings, congresses, and conferences all serve as focused events that are vital to fulfilling NCKRI's diverse mission. NCKRI has hosted, or will host, three events in calendar year 2013, two in 2014, and has at least one a year planned for 2015 through 2019. Below are descriptions of conferences held during the year of this report and those planned through 2014. For more information and to register for these upcoming events, visit www.nckri.org.

Karst Waters Institute Symposium : Carbon and Boundaries in Karst

On January 7-11, 2013, the Karst Waters Institute held its most recent conference at NCKRI Headquarters. It was co-organized by NCKRI and in cooperation with Karst Research Institute (KRI) of Slovenia. This meeting attracted a highly specialized group of about 50 scientists from eight countries. They presented 47 papers on the changes in inorganic and organic carbon between the surface and subsurface in karst systems. The papers will be published in an upcoming special issue of KRI's journal *Acta Carsologica*. The conference

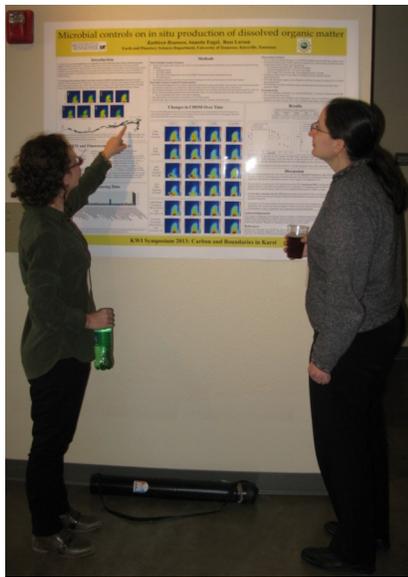


Photo by Suzanna Langowski
Carbon and Boundaries Poster Session



Photo by Suzanna Langowski
Carbon and Boundaries participants at NCKRI's Jim White sculpture.

included an opening reception, closing banquet, field trip to Carlsbad Cavern, and many opportunities for networking and comparing notes on the latest advances in karst science.

13th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst

Since 1984, "The Sinkhole Conference" series has been among the most significant in creating a better understanding of karst processes that result in environmental problems. Now under NCKRI's management, on May 6-10, 2013, it attracted 113 people from eight countries. The conference's 52 papers highlighted effective methods to identify karst impacts before they occur, prevent them from occurring, and remediate them when they do occur. In addition to many social activities, field trips included a detailed examina-

tion of the Pecos Valley evaporite karst, a 650-m descent into the transuranic waste repository of the Waste Isolation Pilot Plant (WIPP), a geological tour of Carlsbad Cavern, and a variety of shopping and tourist trips throughout the region. The 480-page proceedings are available for free download from the NCKRI website, the Karst Information Portal, and www.sinkholeconference.com where information on the upcoming 2015 Sinkhole Conference in Rochester, Minnesota is posted.



Photo courtesy of J. Brad Stephenson
Sinkhole scientists deep underground touring WIPP.

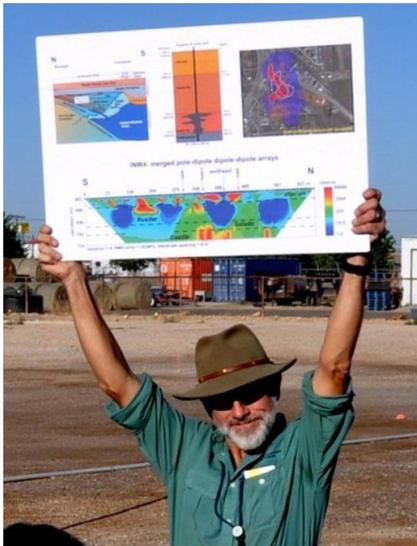


Photo courtesy of Harry Moore Lewis Land providing geophysical context at Stop 1 of the Sinkhole Conference field trip.

20th National Cave and Karst Management Symposium

The National Cave and Karst Management Symposium (NCKMS) is the world's longest-running conference series on cave and karst management issues. It began in New Mexico in 1975 and will return for its 20th meeting on November 4-8, 2013 in Carlsbad. NCKRI will host this NCKMS in close partnership with the Bureau of Land Management, the National Park Service, and the US Forest Service.

"NCKMS: A Changing Climate" reflects this symposium's theme, not just on how climate change is or might impact caves and karst systems, but the changing attitudes, laws, funding sources, and other factors which are crucial to cave and karst management. In addition to the usual array of papers, a diverse mix of four workshops and four field trips will be offered.

NCKRI will also host two national board meetings in association with NCKMS. The Cave Research Foundation's Board of Directors will meet immediately before the symposium and the National Speleological Society's Board of Governors will meet immediately afterward.



Photo courtesy of Harry Moore Sinkhole conference field trip participants at Cottonwood Lake sinkhole, Bottomless Lakes State Park.

2014 Karst Interest Group Meeting

The Karst Interest Group (KIG) meets roughly every three years to encourage and support interdisciplinary collaboration and technology transfer among US Geological Survey (USGS) scientists working in karst areas. The KIG also encourages cooperative studies between the USGS and other Department of Interior agencies, and with university researchers and research institutes. This 6th KIG Meeting will be held at NCKRI Headquarters on April 28 - May 2, 2014. As the westernmost KIG, the field trip and probably many of the papers will focus on arid and evaporite karst hydrogeology, and the special research and management challenges posed by those environments.



International Workshop on Ice Caves VI

The International Workshop on Ice Caves (IWIC) is a series of workshops devoted entirely to ice cave research. IWIC is the only conference focused on state-of-the-art ice cave research, where international experts discuss ongoing research efforts and promote global cooperation in ice cave science and management. IWIC is a conference of the Glacier, Firn, and Ice Caves Commission of the International Union of Speleology. IWIC-VI is being hosted by NCKRI on August 17-22, 2014, in Idaho Falls, Idaho. This will be the first IWIC held outside of Europe.



Photo courtesy of Harry Moore JWS sinkhole, northern Eddy Co., New Mexico; one of the stops on the Sinkhole Conference field trip.

OUTREACH

Professional Partnerships

NCKRI formally defined its partnership categories this year and has begun reaching out to establish formal partnerships with several agencies and organizations. One was completed, a Memorandum of Understanding (MOU) with the US Forest Service. The purpose of the MOU is broad. It defines the general relationship and intent to work together when possible for mutual benefit and the advancement of cave and karst science, education, and management. It also serves as the foundation for developing agreements for specific joint projects. We look forward to working with the US Forest Service for many years to come.

A couple of years ago NCKRI teamed with Engineers Without Borders (EWB) on a field project that solved a karst flooding problem in north-central Guatemala. EWB continues to work with NCKRI, this year getting hydrogeological advice on safely developing a sanitation system for the village of Ak' Tenamit in a karst area of eastern Guatemala. NCKRI is proud to work with humanitarian organizations like EWB to solve karst challenges wherever they occur.

Tragic sinkhole collapses were featured in the national news this year. As a result, NCKRI sponsored a congressional briefing on sinkholes with the American Geosciences Institute, Association of American State Geologists, and Association of Environmental and Engineering Geologists. The April 2013 briefing was conducted in cooperation with Representative Steve Southerland from Florida's 2nd District. NCKRI was represented by Board Director David Weary at the Washington, DC event.

Professional Meetings

NCKRI attended, sponsored and/or had a booth at the following conferences during the past year:



Photo courtesy of Maeve Boland, AGI
Congressional Briefing on The Science of Sinkholes: Living and Building in Karst Areas. Pictured above (L-R): Michael Knight (Association of Environmental and Engineering Geologists), Dan Doctor (US Geological Survey), David Weary (US Geological Survey and NCKRI Board Director), Jon Arthur (Association of American State Geologists).

- 13th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst; Carlsbad, New Mexico.
- Carbon and Boundaries in Karst Symposium; Carlsbad, New Mexico.
- Geological Society of America Convention; Minneapolis, Minnesota.
- Geological Society of America Regional meeting; Albuquerque, New Mexico.
- *Caves and astrobiology* for Freshman Honors program, University of New Mexico, Albuquerque, New Mexico.
- *Caves in New Mexico, caves in the Solar System*. Summer Sciences program, New Mexico Tech, Socorro, New Mexico.
- *Caves in New Mexico and the World: a primer for docents*. Docent Training Class, New Mexico Museum of Natural History and Science.

Guest Lectures by NCKRI

Drs. Boston, Land, and Veni were invited to give the following presentations and lectures:

- *Acid metal rock: the music of the subsurface geomicrobes*. Geobiology Gordon Conference, Ventura, California.
- *BatsLive!* US Forest Service webinar.
- *Big Manhole Cave geophysical research: status report*. Southwestern Region of the National Speleological Society's Winter Technical Meeting, Albuquerque, New Mexico.
- *Chemotrophy meets heterotrophy: the inverted critical zone of the subsurface*. Boundaries and Carbon in Karst, Karst Waters Institute and NCKRI sponsored conference, Carlsbad, New Mexico.
- *Electrical resistivity surveys of a potential sinkhole collapse site in a densely populated area: Carlsbad, New Mexico*. New Mexico Tech Earth and Environmental Sciences seminar; Los Alamos Geological Society talk.
- *Exploration Science*, English 389, Communication for University Students.

- *Freshmen, fear, and fortune, and coevolution of life and minerals.* Natural Science Foundation Cutting Edge Teaching Workshop. University of New Mexico, Albuquerque, New Mexico.
- *Humor in presentations.* Science and Communications class, University of New Mexico, Albuquerque, New Mexico.
- *Hydrogeologic controls on the evolution of the Edwards Plateau Karst, Texas, USA.* Karlsruhe Karst Lecturer 4, Karlsruhe Institute of Technology, Karlsruhe, Germany.
- *Lunar lava tubes: science, shelter, habitat.* National Space Society Lunar Conference, Pasadena, California.
- *Mine caves of Sardinia,* New Mexico Tech Cave Club Grotto.
- *Natural cavities and drilling.* Extraterrestrial Drilling Workshop, Goddard Spaceflight Center, Greenbelt, Maryland.
- *New Mexico to Mars: magnificent caves and the extremophiles that call them home.* New Mexico Museum of Natural History and Science, Albuquerque, New Mexico.
- *Overview of the First International Planetary Caves Workshop.* Mars Exploration Program Analysis Group. NASA.
- *Panel on science on Mars. Panel on agriculture on Mars. Evening panel on where to look for life on Mars.* Humans to Mars Conference, George Washington University, Washington, DC.
- *Regional investigations of groundwater residence time using multiple tracers: Southern Sacramento Mountains and Roswell Artesian Basin, New Mexico.* New Mexico Tech Earth and Environmental Sciences seminar.
- *Return to the Mayan maze: Actun Kaua.* Southwest Region of the National Speleological Society's, Winter Technical Meeting, Albuquerque, New Mexico; Bexar Grotto, San Antonio, Texas.
- *The giant crystals and tiny microbes of Naica.* Student Science Symposium, University of New Mexico, Gallup, New Mexico.

- *The global cave wilderness: our underground world heritage.* Center for International Studies, Albuquerque, New Mexico.
- *The National Cave and Karst Research Institute: from inner space to outer space.* Edwards Aquifer Authority Brownbag Luncheon Lecture Series, San Antonio, Texas; International Good Neighbor Council, Carlsbad, New Mexico.
- *Titanic: a personal journey.* American Association of University Women, Socorro, New Mexico; New Mexico Museum of Natural History and Science, Albuquerque, New Mexico.



Photo by Suzanna Langowski
Kenneth Johnson's distinguished lecture on sinkholes filled the house!

- *Why we live where we live: the impact of karstic water resources on settlement patterns in southeastern New Mexico.* An introductory earth science course at New Mexico State University-Carlsbad.

Dr. Veni also organized or co-organized the following events:

- Served as a Scientific Committee member of the International Workshop on Ice in Caves V, Barzio and Milan, Italy, September 2012.
- Co-led a field trip into Carlsbad Cavern for the Society of Environmental Journalists Conference, October 2012.

Distinguished Lecture Series

Dr. Kenneth Johnson, Emeritus Scientist of the Oklahoma Geological Survey, presented *Salt dissolution and sinkholes in west Texas and southeast New Mexico* on May 6, 2013. With sinkholes being very much in the news this spring and the potential of a major sinkhole developing in Carlsbad, this talk was especially well attended.

Co-Sponsored Speakers

NCKRI co-sponsors the Edwards Aquifer Authority's Distinguished Lecture Series in San Antonio, Texas. This year Dr. John "Jack" Sharp spoke on *Groundwater—Texas style: understanding and utilizing geology, hydrology, and environmental concern for groundwater resources in a place of critical socioeconomics, law, and politics* in June 2013.

National Involvement

Dr. Penelope Boston:

- Attended the NASA Planetary Protection Subcommittee, December 17-20, 2012. NASA Headquarters, Washington, DC.
- Attended the NASA Innovative Advanced Concepts External Council meetings, November 13-16, 2012. Norfolk, Virginia; March 12-14, 2013, Chicago, Illinois.
- Participated in the Astrobiology Roadmapping for the Next Decade. Astrobiology Meeting of Experts, NASA Wallop's Island Flight Facility, Virginia.

Dr. George Veni:

- Continued his three-year appointment by the Secretary of the US Department of the Interior to serve on the Resource Advisory Council for the Bureau of Land Management's Pecos District. The council meets 2-4 times a year to collect and analyze information, make field observations, hear public comments and develop recommendations for the Bureau.
- Continues his service on the Aquifer Science Advisory Panel of the Edwards Aquifer Authority (EAA). The panel meets about twice a year in San Antonio, Texas, to review active and

proposed EAA research and management programs.

- Was invited to represent NCKRI as a member of the US Fish and Wildlife Service's White-Nose Syndrome Stakeholder Committee.
- Served as an independent reviewer of plans and decisions proposed by the US Fish and Wildlife Service for endangered karst species and karst species proposed for endangered listing.
- Served as technical advisor for Texas' Greater Edwards Aquifer Alliance Low Impact Development Manual for urban development over the karstic Edwards Aquifer.

Community Involvement

NCKRI staff:

- Provided annual briefings on NCKRI to the Carlsbad City Council and Eddy County Commissioners.
- Participated in the Carlsbad Chamber of Commerce's annual *Bat Brigade*. This delegation of community leaders visits leaders of New Mexico government at the state capitol to raise their awareness and support for issues in the City of Carlsbad and Eddy County.
- Celebrated their seventh year of partnership with the Bureau of Land Management, National Park Service, and National Forest Service in *Relay for Life*, a nationwide campaign to raise awareness and funds to fight cancer.
- Regularly attended board meetings of the Carlsbad Chamber of Commerce, and its Government Affairs and Tourism Committees, Carlsbad Department of Development and its Cascades Committee, and participated in groundbreakings and related activities supporting new businesses and community leaders.
- Participated in the annual Carlsbad Chamber of Commerce Business Fair.
- NCKRI hosts the monthly meetings of the Pecos Valley Grotto of the National Speleological Society on the third Thursday of each month at 7 p.m. Anyone interested in caves, cave

exploration, and cave research is welcome to attend.

Media

Dr. Penelope Boston:

- Was interviewed by BBC Radio on Mars exploration.
- Was interviewed by *CBS Saturday Morning* on the Mars Curiosity lander, life in the Mars subsurface.
- Took part in the Carlsbad Caverns film shoot for National Park Service.

Dr. Lewis Land:

- Was interviewed by the Carlsbad Current-Argus, CNN, and National Public Radio's *Talk of the Nation* about sinkholes, their origins, and risks to public.

Suzanna Langowski:

- Was the weekly featured interview in *Vamanos!* Magazine, Carlsbad Current-Argus and Ruidoso News.

Dr. George Veni:

- Was interviewed multiple times about how an endangered species of blind cave spider, named in his honor 21 years earlier, might affect construction of a highway in Texas.
- Gave interviews to the British Broadcasting Corporation, Carlsbad Current-Argus, and the *How To Do Everything* podcast about sinkholes, their origins, and risks to the public.
- Was the weekly featured interview in *Vamanos!* Magazine, Carlsbad Current-Argus and Ruidoso News.
- Wrote two commentaries for the Carlsbad Current-Argus, updating the public on NCKRI and the status of a potential sinkhole that may form in town.
- Was interviewed by the Carlsbad Current-Argus about the *Carbon and Boundaries in Karst Symposium* that NCKRI hosted in January 2013.
- Gave an interview to the Pecos Enterprise newspaper on NCKRI's dye tracing study in Balmorhea, Texas (see page 2 for details).
- Consulted and was filmed for The Weather Channel's *Secrets of the Earth* series for the episode *Strangest Places* that features Caverns of Sonora, Texas. The episode is scheduled for broadcast in Summer 2013.

BOARD ACTIVITIES

The Board met in Charlotte, North Carolina in November 2012 and at NCKRI Headquarters in May 2013. The Board also met via telephone in August and had an on-line vote in January.

Actions of the Board

- Revisions were made to the By-Laws updating election procedures, term limits, and membership classes.
- Memoranda of Understanding were signed with the International Academy of Karst Sciences and the US Forest Service.
- The Board decided to free additional money from the reserve fund to be used for fund raising; the reserve fund will contain six months of operating expenses.
- New officers were elected this spring: Robert Brinkmann (NY), Chairman of the Board; Geary Schindel (TX), Vice Chairman, and Jesse Richardson (WV), Executive Committee Member -at-Large.
- Paula Dye (FL) retired from the board and Jack Swickard (NM) was elected to replace her.

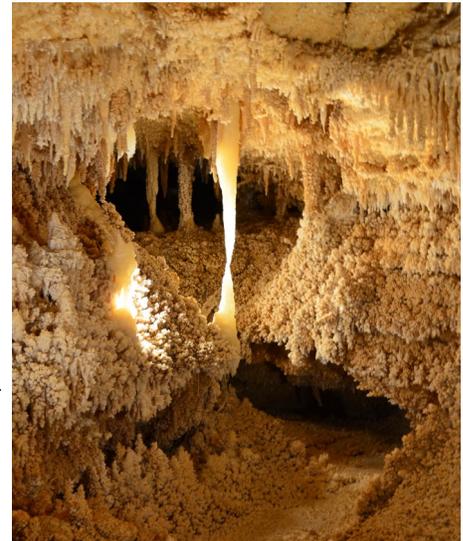


Photo by George Veni
The many crystalline passages of Caverns of Sonora are too delicate to walk on but NCKRI was interviewed from its tourist trails for a special episode on The Weather Channel's Secrets of the Earth series.

BOARD OF DIRECTORS

Hazel Medville, Chairman

Member since 2005, Chairman 2006-2013, Bachelor's Degree in Statistics and Computer Science. Hazel is a retired Computer Engineer/Manager who now spends much of her time surveying caves in Hawaii and Colorado. She was the President Pro-Tem and Government Liaison for the National Speleological Society, the Technical Program Chairman for the 15th International Congress of Speleology, and is currently the Director of the West Virginia and Hawaii Speleological Surveys. In 2003, Hazel was honored to receive the William J. Stephenson Outstanding Service Award from the National Speleological Society in recognition of her long term contributions to the society.

Dr. Robert Brinkmann, Vice-Chairman

Member since May 2010; Bachelor's and Master's degrees in Geology, PhD in Geography. Professor and Director of Sustainability Studies at Hofstra University and the Director of Sustainability Research at the National Center for Suburban Studies. Bob works on many karst issues, particularly karst policy, urban karst, environmental sustainability, and geomorphology. He recently authored the book, *Florida Sinkholes: Science and Policy*.

Richard Cervantes, Secretary/Treasurer

Member since 2005; permanent position representing New Mexico Tech (NMT); Master's Degree in Accounting and Information Systems, and is also a CPA. Richard is NMT's Associate Vice President of Research and Economic Development. He is responsible for administrative affairs including budget preparation, fiscal and project management, proposal development and contract negotiation, and provides oversight for those ac-

tivities at NCKRI.

Anna Beason

Member since October 2011; permanent position appointed by the Mayor of Carlsbad, New Mexico; Bachelor's Degree in Business Administration. Anna has over 26 years of experience in fiscal management, 24 of those with the City of Carlsbad. As the City's Project Administrator, Anna oversees capital improvements, grant administration, project management, and fiscal administration, Anna was instrumental in the construction and funding of NCKRI Headquarters and continues to support NCKRI.

Dave Steensen

Member since January 2009; permanent position representing the National Park Service (NPS); Bachelor's Degree in Geology, Master's Degree in Environmental Systems/Applied Geology. Dave is the NPS Geologic Resources Division Chief. One of his responsibilities is oversight and support of the Service-wide cave and karst resource management program.

Dr. John (Jack) Hess,

Member since 2005; Member at Large of the Executive Committee 2005-2012; PhD in Geology. He is the Executive Director of the Geological Society of America (GSA). Prior to joining GSA in 2001, he was Executive Director of the Division of Hydrologic Sciences and Vice President for Academic Affairs at the Desert Research Institute in Nevada. He serves on the boards of the Karst Waters Institute and Longs Peak Council of the Boy Scouts of America, as well as NCKRI. He is a Fellow of GSA, the National Speleological Society, and the Cave Research Foundation.

Dr. E. Calvin Alexander, Jr.

Member since October 2011; Bachelor's Degree and PhD in Chemistry.

Calvin is a Professor in the Earth Sciences Department at the University of Minnesota, Minneapolis. He serves on the Board of the Deep Portage Learning Center. He is a Fellow of the National Speleological Society. Calvin works on many aspects of karst hydrogeology and the impacts of human activities, particularly agriculture, on karst systems and vice versa, the limits that karst systems place on sustainable agriculture and other human activities.

Paula Dye, AICP

Member since October 2011; Bachelor's and Master's degrees in Geography. Paula is the Strategic Planning Manager for Tampa Bay Water. She has been with the agency since 1997, and manages the agency's long-term water supply planning program, serves as liaison with local and regional government planning officials, and directs the its outside funding and legislative program. She is a member of the American Planning Association and the American Water Works Association. Paula obtained her membership in the American Institute of Certified Planners (AICP) in 1998.

Jim Goodbar

Charter board member; Bachelor's Degree in Park and Recreation Management; graduate studies in cave and



Photo by Dianne Joop
Outgoing NCKRI Board Chairman Hazel Medville receives a bat sculpture from the staff as thanks for her leadership

karst resources, geology, and geomorphology. Jim works in Carlsbad for the US Bureau of Land Management (BLM) as the Senior Cave and Karst Resources Specialist with the Washington Office. He serves as BLM New Mexico State Cave Coordinator and Senior Cave and Karst Specialist for the BLM Pecos District and the Carlsbad Office. His primary responsibilities: establish policy and provide guidance on cave/karst resource management to all BLM offices, serve as the international point of contact for all cave/karst related issues and requests for assistance, develop and conduct training for cave/karst resources, and develop best management practices for land use in karst.

Dr. Ronald T. Green

Member since 2007; Bachelor's in Industrial Engineering; Bachelor's in Geology; Master's in Geophysics; PhD in Hydrology. Ron is a hydrogeologist with the Southwest Research Institute, San Antonio, Texas, where much of his work focuses on karst aquifers.

Dave Lester

Member since May 2012; Master's Degree in Business Administration. Dave has spent over 3 decades founding, building, and operating successful entrepreneurial companies and guiding non-profit organizations. As a principal and chief officer, he has managed two public offerings and served as president, executive VP, board member, secretary, treasurer and chief financial officer of NASDAQ traded public companies. He was an advisor during the founding and early years of NCKRI. Dave is a Fellow of the National Speleological Society (NSS), has served on its Board, and co-chaired and chaired its 1996 and 2011 conventions. He has been actively involved in cave and karst research and exploration in the US and internationally, including National Geographic and NSS sponsored projects. He holds issued and pending United States and international patents

and a commercial pilot license.

Dale Pate

Member from 2000-2002; 2006 to present. Bachelor's Degree in Geography. Dale served as the Cave Specialist for Carlsbad Caverns National Park from July 1991 through June 2012, becoming the National Cave and Karst Program Coordinator for the National Park Service within the Geologic Resource Division beginning in July 2012.

***Jesse Richardson
Member-at-Large***

Member since May 2010, Executive Committee Member-at-Large since 2012; Bachelor's and Master's Degrees in Agricultural and Applied Economics from Virginia Tech; Juris Doctor from the University of Virginia School of Law; Jesse is the Lead Land Use Attorney at the Land Use and Sustainable Development Law Clinic, West Virginia University.

Geary Schindel

Member since 2004; Bachelor's Degree in Geology and a Master's Degree in Geography. Geary is the Chief Technical Officer of the Edwards Aquifer Authority in San Antonio, Texas, and directs the Aquifer Science Research Program. The Edwards Aquifer is a major karst aquifer that provides water to more than 1.7 million people in south-central Texas.

David Weary

Member since June 2009, Bachelor's Degree in Geology from George Mason University, Master's in Geology from Virginia Tech. He has worked for the US Geological Survey (USGS) in Reston, Virginia, since 1988; represents USGS on the NCKRI Board. A research geologist, he is Chief of the USGS KARST Project, which includes hydrogeologic studies and geologic mapping in the Missouri Ozarks and Shenandoah Valley of the Virginias, and work on the new national karst map in cooperation with NCKRI and the National Speleological Society.

NCKRI STAFF

***Dr. George Veni,
Executive Director***

Dr. Veni is an internationally recognized cave and karst hydrogeologist. Prior to NCKRI, he owned and served as principal investigator of George Veni and Associates for over 20 years. He has conducted karst research throughout the United States and in several other countries. His administrative work includes serving as the Executive Secretary of the National Speleological Society's Section of Cave Geology and Geography for 11 years, President of the Texas Speleological Survey for 13 years, Adjunct Secretary of the International Union of Speleology (UIS) from 2002-2009, and UIS Vice President of Administration since 2009. He has served as a committee member of geological, geographical, and biological dissertations at The University of Texas and Harokopio University (Greece), and taught karst geosciences courses for Western Kentucky University for 12 years. He has published and presented over 190 papers and five books, on hydrogeology, biology, and environmental management in karst.



**Dr. Penelope Boston,
Academic Director**

Dr. Boston teaches classes in cave and karst science, geomicrobiology, astrobiology, and global systems, and supervises graduate students studying those topics at New Mexico Tech. She received a National Research Council Postdoctoral Fellowship at NASA-Langley Research Center and has held positions at the National Center for Atmospheric Research, University of Colorado, University of New Mexico. She founded her own non-profit research institute (Complex Systems Research Inc.) and operated it for 14 years before joining NCKRI in 2002.

Dr. Boston is a Fellow of the NASA Institute for Advanced Concepts, Past President of the Association of Mars Explorers, and Senior Editor of the journal *Astrobiology*. She is a member of NASA's Advisory Council Committee on Planetary Protection, a member of the National Academy of Sciences COMPLEX committee, and past advisory board member for the *Journal of Cave & Karst Studies*.



**Suzanna Langowski,
Advancement Director**

Ms. Langowski joined NCKRI in August 2012. She began her professional career as an archaeologist studying human adaptations during the Pleistocene period in Europe. Her PhD research took her to Ukraine, where she spent two years on excavation projects in Crimean caves with the National Academy of Sciences of Ukraine.

Prior to joining NCKRI, Ms. Langowski served as a principal investigator at the US Army Corps of Engineers Construction Engineering Research Laboratory as a Cultural Resources Program Manager at Fort Campbell, Kentucky. Her successful record of obtaining funding for research, preservation, and collections management activities in an environment of increasing competition for limited funds is testimony to her dedication to ensuring that precious natural and cultural resources are protected, understood, and enjoyed.

Ms. Langowski has held chair and board positions for several organizations, including the Military Family Member Scholarship Fund and the Community Assistance Program of the Fort Leavenworth Spouses' Club. She is an active member of the Carlsbad Chamber of Commerce and also a member of national level organizations such as the Association of Fundraising Professionals, and its New Mexico Chapter, and the National Speleological Society.



**Dianne Joop,
Education Director**

Ms. Joop began working for NCKRI in June 2009 and brought a wealth of teaching experience, both formal and informal. While most of this experience was gained in Kentucky and Tennessee classrooms teaching at many levels, she also worked with cave and karst education programs with the National Park Service, American Cave Conservation Association, and Western Kentucky University. Ms. Joop holds a Master's Degree in Education, with a focus on science and history, and she has served as the Education Division Chief of the National Speleological Society. She is an active and experienced cave explorer and surveyor on multiple and diverse projects.

Ms. Joop brings a broad and creative set of talents to NCKRI, with a Bachelor's Degree in Theatre, and through a decade of theatrical and television production experiences with Kentucky Educational Television, the state of Florida, Discovery Channel, and more. Since joining NCKRI, she now serves on education and cave and karst management committees for Carlsbad Municipal Schools and the US Forest Service, and conducts cave and karst education programs nationally. In addition to her education projects at NCKRI, she also serves as NCKRI's webmaster.



**Dr. Lewis A. Land,
Karst Hydrologist**

Dr. Land is a karst hydrogeologist with the New Mexico Bureau of Geology & Mineral Resources (NMBGMR). He serves as the Bureau's liaison with NCKRI and as NCKRI's lead geophysical investigator. Prior to his career as a hydrogeologist, Dr. Land spent eight years in the petroleum industry exploring for new oil reserves in the Mid-Continent and Rocky Mountain regions of the U.S., and offshore West Africa. He received his PhD from the University of North Carolina-Chapel Hill, where his doctoral research included submersible investigations of submarine sinkholes in the Straits of Florida. Before coming to work for NCKRI and NMBGMR in 2002, Dr. Land spent two years with the North Carolina Division of Water Resources conducting geophysical surveys of aquifers beneath the coastal plain of North Carolina.

Dr. Land's current research mostly focuses on regional investigations of karstic aquifers and associated phenomena in southern New Mexico, but have extended as far as Guatemala on NCKRI projects. He has served on several graduate student committees at New Mexico Tech (NMT), and is an adjunct faculty member in the NMT Department of Earth and Environmental Sciences. He is a Past-President of the New Mexico Geological Society (NMGS), and served for five years on the NMGS Executive Committee.



**Debbie Herr,
Office Manager**

Debbie joined NCKRI in January 2008 to organize and lead its administrative activities after working as a secretary in the Truth or Consequences Municipal School District for over 11 years. She received her Associate's Degree in Secretarial Administration from New Mexico State University at Carlsbad, and has over 26 years experience as a secretary and administrative assistant. Debbie maintains NCKRI's document and financial records, and serves as interim publisher for NCKRI, producing the annual report series and other materials.



Continuing Staff Education

NCKRI staff polish and expand their skills whenever possible. Formal training attended by one or more staff members in the past year includes:

- National Association for Interpretation Certified Trainer Course.
- National Association for Interpretation Certified Interpretive Guide.
- Youth Conservation Corps Grant Writing Seminar.
- The Role of Southeast New Mexico in the Global Economy.
- *Use of Geophysics to Detect Solutional Features in Karst*. National Speleological Society webinar by Ron Green, March 2013.
- *Groundwater—Texas Style: Under-*

standing and Utilizing Geology, Hydrology, and Environmental Concern for Groundwater Resources in a Place of Critical Socioeconomics, Law, and Politics. Dr. John Sharp, Distinguished Lecture Series, Edwards Aquifer Authority, June 2013, San Antonio, Texas.

- *Managing the Capital Campaign*. Indiana University School of Philanthropy, June 2013, Minneapolis, Minnesota.

Staff Publications

Refereed Papers

Conference Papers

- Land L. Evaporite karst in the Permian Basin region of west Texas and southeastern New Mexico: The human impact. In: Land L, Doctor DH, Stephenson JB, editors. National Cave and Karst Research Institute Symposium 2. Proceedings of the 13th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impact of Karst; 2013 May 6-10; Carlsbad, (NM): National Cave and Karst Research Institute; 2013. p. 113-121.
- Land L, Timmons, S. 2012. Regional investigation of groundwater residence time using multiple tracers: southern Sacramento Mountains, New Mexico, USA. GSA Abstracts with Programs.
- Veni G. Government Canyon State Natural Area: an emerging model for karst management. In: Land L., Doctor. DH, and Stephenson, JB, editors. National Cave and Karst Research Institute Symposium 2. Proceedings of the 13th Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts on Karst; 2013 May 6-10; Carlsbad, (NM): National Cave and Karst Research Institute; 2013. p. 433-440.

Conference Proceedings

- Land L, Doctor DH, Stephenson JB, Editors. National Cave and Karst Research Institute Symposium 2. Proceedings of the Thirteenth

Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impact of Karst, Carlsbad, New Mexico: 2013. 113-121p.

Journal Papers

- Land, L. Geophysical prospecting for new cave passages: Fort Stanton Cave, New Mexico, USA. *Carbonates and Evaporites* 2012;27(2):97-102.
- Land L. 2013. Geophysical records of anthropogenic sinkhole formation in the Delaware Basin region, southeast New Mexico and west Texas, USA. *Carbonates and Evaporites* 2013;28(1-2):183-190.
- Land L, Veni G. 2012. Electrical

resistivity surveys of anthropogenic karst phenomena, southeastern New Mexico. *New Mexico Geology* 34 (4):117-125.

- Spilde, M.N., Melim, L.A., North-up, D.E., Boston, P.J. 2013. Anthropogenic lead as a tracer of rock varnish growth: Implications for rates of formation. *Geology* 41 (2):263-266.

Books and Book Chapters

- Johnson S, Schindel G, Veni G, Hauwert N, Hunt B, Smith B, Gary M. 2012. Tracing groundwater flowpaths in the vicinity of San Marcos Springs, Texas. Edwards Aquifer Authority Report No. 12-01, 147 p.

- Land L, Veni G. 2012. Electrical resistivity survey of Intrepid Potash injection well site: Eddy County, New Mexico. NCKRI Report of Investigations 3, 9 pp.

Peer Review

Dr. Lewis Land:

- Reviewed a karst hydrogeology manuscript for the *Hydrogeology Journal* and an evaporite karst hydrogeology paper for the *Journal of Cave and Karst Studies*.

Dr. George Veni:

- Reviewed two karst hydrogeology papers for *Acta Carsologica* and *Journal of Hydrology*, and a karst geophysics paper for the *South Texas Geological Society Bulletin*.

2012-2013 BUDGET

| | National Park Service | | State of New Mexico | | COMBINED | |
|--|-----------------------|------------------|---------------------|------------------|---------------------------|---------------------------|
| | FY 11-12 Actuals | FY 12-13 Actuals | FY 11-12 Actuals | FY 12-13 Actuals | FY 11-12 Combined Actuals | FY 12-13 Combined Actuals |
| Beginning Fund Balance | | | 508,392 | 277,681 | 508,392 | 277,681 |
| Revenues | | | | | | |
| State Appropriation | 0 | 0 | 377,704 | 377,700 | 377,704 | 377,700 |
| Federal Appropriation | 323,000 | 309,201 | 0 | 0 | 323,000 | 309,201 |
| TOTAL REVENUES & FUND BALANCES | 323,000 | 323,000 | 886,096 | 655,381 | 1,209,096 | 964,582 |
| Expenses | | | | | | |
| Personnel | | | | | | |
| Staff Salaries & Student Wages | 177,570 | 171,803 | 236,507 | 212,632 | 414,077 | 384,435 |
| Fringe Benefits | 60,092 | 58,374 | 62,719 | 62,334 | 122,811 | 120,708 |
| Total Personnel | 237,662 | 230,177 | 299,226 | 274,966 | 536,888 | 505,143 |
| Operating | | | | | | |
| Rent, Utilities, Telephone | | 0 | 73,926 | 50,185 | 73,926 | 50,185 |
| Supplies & Other | 18,968 | 27,447 | 40,215 | 16,922 | 59,183 | 44,369 |
| Exhibit Design | 0 | 0 | 153,268 | 32,250 | 153,268 | 32,250 |
| Travel | 13,073 | 7,572 | 14,338 | 9,017 | 27,411 | 16,589 |
| Contractor Services | 4,133 | 2,540 | 7,442 | 14,487 | 11,575 | 17,027 |
| Property & Equipment | 7,069 | | | | 7,069 | 0 |
| NMT Administrative Support | 0 | 0 | 20,000 | 20,000 | 20,000 | 20,000 |
| NMT "Indirect" from NPS Budget (8%) | 22,071 | 21,465 | 0 | 0 | 22,071 | 21,465 |
| NPS "Indirect" to GRD at 6% on NPS appropriation | 20,000 | 20,000 | 0 | 0 | 20,000 | 20,000 |
| Total Operating | 85,314 | 79,024 | 309,189 | 142,861 | 394,503 | 221,885 |
| TOTAL FUNDS EXPENDED | 322,976 | 309,201 | 608,415 | 417,827 | 931,391 | 727,028 |
| Ending Fund Balance | 24 | 13,799 | 277,681 | 237,554 | 277,705 | 237,554 |

