



Inside Earth



Over a dozen cave and karst managers attended the week-long National Cave Rescue Commission’s Operations and Management seminar in Divide, Colorado. Back row, left to right: Blase LaSala, Physical Science Tech, TICA; Matthew Martin, Park Ranger, GRBA; Shawn Thomas, Cave Technician, CAVE; Eddy Cartaya, Law Enforcement, Deschutes Natl. Forest; Gretchen Baker*, Ecologist, GRBA; Andy Armstrong*, Physical Scientist, TICA; Bonny Armstrong, Biological Science Tech, TICA; Rene Ohms*, Chief of Resource Management, DETO. Front row, left to right: Katrina Smith, Physical Science Tech, LBE; Leigh Knudsen, Wilderness Specialist, BLM; Marc Ohms*, Physical Science Tech, WICA; Stan Allison, Cave Technician, CAVE; Brian Chartier, Law Enforcement, BLM. Photo by Mark Dickey. *NCRC Instructors

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A Word from WASO

Submitted by Dale Pate

Calendar

National Speleological Society (NSS)
Convention
July 14-18, 2014

NSS Headquarters, Huntsville,
Alabama
www.nss2014.caves.org

6th International Workshop on Ice
Caves

August 17-22, 2014
Idaho Falls, Idaho
<http://www.iwic-vi.org/>

Geological Society of America
Annual Meeting
October 19-22, 2014
Vancouver, British Columbia,
Canada

www.geosociety.org/meetings/2014/

George Wright Society Conference
March 29-April 2, 2015
Oakland, California
www.georgewright.org

NSS Convention
July 13-17, 2015
Waynesville, Missouri
<https://www.facebook.com/NSSConvention2015>

Geological Society of America
Annual Meeting
November 1-4, 2015
Baltimore, Maryland
<http://www.geosociety.org/meetings/2015/>

NSS 75th Anniversary Convention
July 17-23, 2016
Ely, Nevada
<https://www.facebook.com/nss75th>

Submit entries for the Calendar to
bonny_armstrong@nps.gov

HIGHLIGHTS OF THE NATIONAL CAVE AND KARST PROGRAM

The National Cave and Karst Program continues to move forward in several directions. We have a new editor for Inside Earth and have a summer Geoscientist-in-the-Parks (GIP) to work on educational materials. And Limaris Soto, a contractor for the last 6 months, will continue working on a variety of projects as a Guest Scientist through the GIP program. Updates including recent park visits for technical assistance requests made this spring are as follows.

PERSONNEL

Thanks to Andrea Croskrey for editing four issues of Inside Earth, from Spring 2012 to Fall 2013. As some of you may know, Andrea recently took a position at the Texas Water Development Board in Austin, Texas. We appreciated Andrea's enthusiasm and interest in the cave and karst program and editing Inside Earth. We wish her well in her new position. Meanwhile, Bonny Armstrong has agreed to be editor and we look forward to enjoying the issue(s) she produces.

Welcome to Joe T. Camacho Jr., a new Geoscientist-in-the-Parks (GIP) working for the summer in the Geologic Resources Division for the Cave and Karst Program. A recent graduate from Humboldt State University, Joe will be designing a Jr. Cave Scientist Program booklet and badge as his main duties. We hope to have a draft electronic version of the booklet completed and ready for review before he heads off to work on a Master's degree in August.



Dale Pate, NPS National Cave and Karst Coordinator. Photo by Johanna Kovarik.

NCKRI REPORT

The National Cave and Karst Research Institute has completed a report for the National Park Service (NPS) titled "Evaluation of Cave and Karst Programs and Issues at US National Parks." By comparing karst location information provided by the USGS with park unit locations and reviewing other reports on cave and karst resources, this report indicates that at least 191 park units should have caves and/or karst features. Starting on page 55, Appendix F lists these park units. This report also provides observations and recommendations based on a recent survey of park units with cave and karst resources in the following categories: General, Research, Management, and Education. The report can be found at http://nature.nps.gov/geology/caves/publications/NCKRI_RI_4.pdf.

DRAFT CAVE AND KARST SUMMARIES

Limaris Soto, a contractor during this period, completed draft cave and karst summaries for twenty additional park units bringing to 50 the total number of parks with draft summaries. These general summaries are used to provide information for both the Foundation



A tricolored bat in the front portions of Mammoth Cave displaying symptoms of White-Nose Syndrome including damage to wings, ears, and nose. NPS photo by Dale Pate.

and State of the Parks programs that are ongoing in the National Park Service for park units. As well, final summaries will be made available to the public for educational and informational purposes. Look for them to start appearing on our Cave and Karst website in the next few months. Draft summaries completed since the last issue of Inside Earth include Bighorn Canyon, Christiansted, Salt River Bay, Devil's Tower, Yucca House, Saint Croix, Dinosaur, Alibates Flint Quarries, Lake Meredith, Montezuma Castle, Tuzigoot, Fort Pulaski, Great Basin, Fort Laramie, Sunset Crater Volcano, Walnut Canyon, Carlsbad Caverns, Bandelier, and Haleakala.

POSTER – CAVES OF THE NATIONAL PARKS

With invaluable help from Jim Wood (also in the Geologic Re-

sources Division), Limaris and I have been working with the American Geosciences Institute (AGI) to design an updated poster titled "Caves of the National Parks". We hope to have this poster available electronically and with printed copies for parks to use by the middle of summer. A number of partners, including the NPS, work with AGI to develop and distribute educational materials during Earth Science Week October 12-18, 2014. This poster will be one of the items distributed in an Earth Science Tool Kit this year. To learn more about Earth Science Week and how to obtain a toolkit, go to the following link: <http://www.earthsciweek.org/> Please see Limaris' article elsewhere in this issue.

TECHNICAL ASSISTANCE SITE VISITS

A critical component of the nation

al program is technical assistance that is provided to requesting park units. This spring I visited two national parks, Mammoth Cave in Kentucky and Great Basin in Nevada to provide support and assistance. My site visit to Mammoth Cave occurred from February 24 – 28 and centered on helping the park in its initial stages of developing a cave and karst management plan. Mammoth Cave's latest (and only) Cave Management Plan was from 1986. In conjunction with this plan, Mammoth Cave is preparing an Environmental Assessment. Rick Toomey will be hosting a scoping session for this planning effort on Monday afternoon at the National Speleological Society (NSS) Convention in Huntsville this coming July. An unfortunate aspect of my visit was the recent discovery of White-Nose Syndrome in tricolored bats in Mammoth Cave.

My site visit to Great Basin occurred March 19-23 and centered on potential lint reduction efforts in Lehman Cave and coincided with the first day of their annual Lint Camp. Lint Camp was very successful drawing a group of interested volunteers from Nevada and nearby states. Discussions also focused on White-Nose Syndrome in bats, the upcoming 2016 NSS Convention in Ely, Nevada, a potential wild caving tour, and completion of a Cave and Karst Management Plan.

To receive this newsletter and pertinent updates and announcements, join the NPS Cave and Karst listserve here:

http://nature.nps.gov/geology/caves/email_info.cfm

Feature Articles

Cave Rescue Training Well Attended by NPS and Other Federal Employees

Submitted by Bonny Armstrong, Biological Science Technician, Timpanogos Cave National Monument

NPS and other Federal employees were well represented among the more than 80 students and 30 instructors who participated in an 8-day cave rescue training in Divide, Colorado, May 16-24. The training was conducted through the National Cave Rescue Commission (NCRC), a commission of the National Speleological Society (NSS).

Camp Golden Bell served as the main venue for the event, providing lodging, meals, classrooms, and a ropes course. Some training activities were conducted on cliff faces in Eleven Mile Canyon Recreation Area, while in-cave trainings took place in several caves in Williams Canyon and at Cave of the Winds in Manitou Springs, CO. Three different levels of training were offered which emphasized rescuer preparedness and safety, cave travel skills, understanding the cave environment, patient care and stabilization, evacuation techniques applicable to the cave environment, single rope techniques for personal vertical movement, rope rescue techniques and rigging, medical considerations, underground communications, and incident management.

After a week of training, the seminar concluded with a full-scale, mock rescue event, in which all students from the various levels participated. The mock rescue scenario involved locating four missing cavers in two different caves



Level 1 students practice moving a packaged patient underground. Photo by Jansen Cardy.

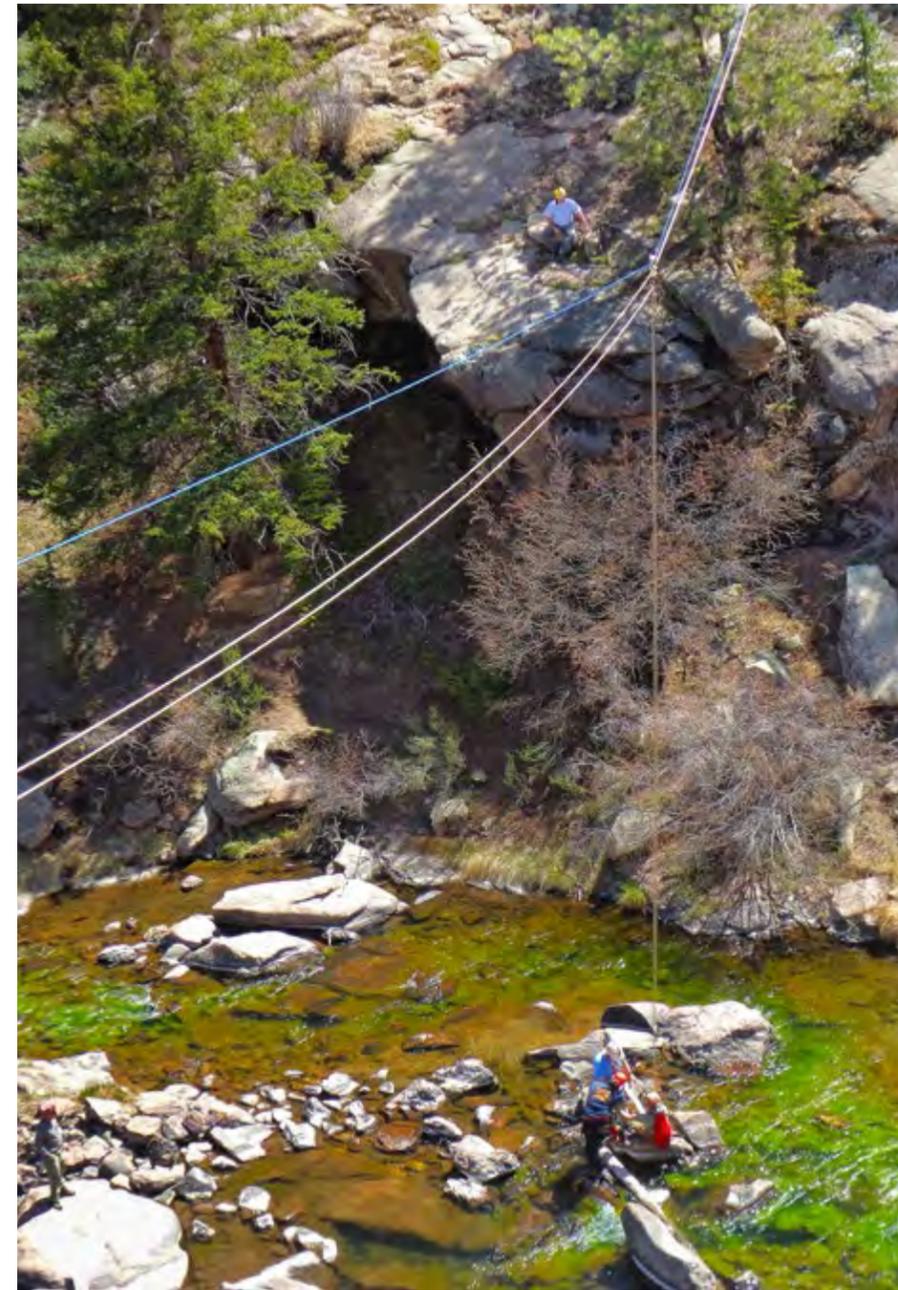
who were found to have a variety of injuries. During the mock rescue, Level 1 students functioned as team members for search, patient packaging and evacuation, rigging, and communication operations. Level 2 students were often used as team leaders for these objectives, while Level 3 students served as the incident command team. The scenario took about 11 hours, and



Students in Williams Canyon. Due to potential flooding, everyone was evacuated from the canyon when a thunderstorm descended upon the area during the mock rescue. Photo by Jansen Cardy.

concluded just in time for a “for real” situation; a thunderstorm, with major flooding potential, caused an emergency evacuation of Williams Canyon where the mock rescue was taking place. Leaving a lot of gear behind, students and instructors hastily exited the canyon, some going up canyon and others down canyon. With heavy rain, and lightning moving closer, students and instructors found themselves separated by roads and a highway closed due to flooding. For three hours, the up-canyon and down-canyon groups were unable to reach each other or return to camp. Eventually the floodwaters receded and everyone was accounted for back at camp by 1:00 a.m.

This weeklong Cave Rescue Operations and Management Seminar is an annual training which is held in various locations around the U.S. In addition to the national weeklong seminar, various regions



Level 3 students operating a highline they constructed to rescue a patient from the river. Photo by Andy Armstrong.

also sponsor weeklong seminars, weekend Cave Rescue Orientation Courses, and other specialized training including Small Party Assisted Rescue courses.

For more information on the NCRC, and upcoming trainings visit <http://caves.org/commission/ncrc/national/>.

Updating the “Caves of the National Parks” Educational Poster and Related Learning Activities

Submitted by Limaris Soto, Guest Scientist, GeoCorps America™

Science education and outreach are aimed at engaging young people, while encouraging a better understanding of math and science. Apart from developing cave and karst summaries for all NPS park units containing these resources, I have been able to help create new educational materials for the NPS Cave and Karst Program. I am currently working on a new poster on “Caves of the National Parks” which will introduce audiences to the fascinating and complex subterranean world.

Last year, Jim Wood, Geologic Heritage and Education Program Lead at NPS Geologic Resources Division (GRD) presented me with the opportunity to update the park service’s “Caves of the National Parks” educational poster. At this time I was reviewing a 3-D karst topography model created by the U.S Geological Survey in 1997 (Alpha et al. 1997). Heather Walborn (GeoCorps America, Guest Scientist) is redesigning the Education and Outreach [website](#) for GRD and felt this would be a great addition to promote science education. This model was a captivating representation of karst terrains and its connections, but it needed a more modern approach. I updated the model and student pages to add it to the poster along with another activity, “Growing Speleothems”, targeted for all ages.

The “Caves of the National Parks”

poster is being produced in collaboration with the American Geosciences Institute (AGI). It includes information about what a cave is, different types of caves, what NPS units have cave and/or karst features, and describes the diverse fields that can be studied within caves (such as archeology and cultural resources, biology, mineralogy, paleoclimatology, and paleontology). In addition, there are descriptions about karst landscapes, White-Nose Syndrome, and the two learning activities are included.

The “Growing Speleothems” activity gives students the opportunity to learn about the process of speleothem formation and simulate the formation of stalactites and stalagmites using a concentrated salt solution. As part of the process the

students record their observations at the end of each day and answer questions related to speleothems and caves. With the “Karst Topography Paper Model” students will construct a 3-D model that represents the movement of groundwater through a karst aquifer. It should be noted, that we contacted and received approval to modify the model by John Tinsley, one of the original authors of the model. Heather, who helped developing the activities, is also in the process of finalizing web pages for both activities.

In order to reach the public, especially the youth, it is important to promote science education and our nation’s parks. With the completion of the “Caves of the National Parks” poster we will provide a visual and engaging representation

of our caves that would be available for many years to come. The two built-in learning activities deliver fun and challenging projects for students that can be completed in a classroom or at home. The poster is expected to be completed by the end of the summer. If you are interested in obtaining more information about the poster contact me at limaris_r_soto@partner.nps.gov. Information about the learning activities can be found at <http://go.nps.gov/learnkarst> and/or <http://go.nps.gov/learncaveminerals>.

References:
Alpha, T.R., Galloway, J.P., and Tinsley, J.C. III. 1997. Karst Topography Computer animations and paper model. Open-file Report 97-536-A. U.S. Geological Survey. Menlo Park, California.

Growing Speleothems

Overview: Students construct a working model of mineral deposition and speleothem growth using a concentrated solution of salt. They can work in groups to interpret and record growth through observation on a daily basis.

Grade Level: Modify for all ages

Lesson Objectives: Students will
• Learn about the process of speleothem formation
• Stimulate the formation of stalactites and stalagmites
• Record observations at the end of each day

Timeframe: 10 minutes for preparing the demonstration, plus several days to grow the speleothems.

Materials:
• 1 small pizza/sauce or piece of aluminum foil
• 1 spoon
• Two paper clips
• 2 jars of the same volume/size
• Epsom salts
• Hot water
• Thick cotton string or yarn (natural fibers)

Learn more about caves and karst: visit the NPS Cave and Karst Program www.nps.gov/caveandkarst/index.htm

U.S. Department of Interior
National Park Service
Geologic Resources Division

Karst Topography Paper Model

Overview: Create a paper model that depicts karst terrain. Interpret and understand that karst systems are dependent upon the relationship between water, land, vegetation and soils.

Grade Level: Grades 9-12

Lesson Objectives: Students will
• Learn about karst topography including sinkholes, caves, and springs
• Recognize that karst terrain are integrated systems and are vulnerable to human activities
• Understand the movement of water in underground systems

Timeframe:
• Two class sessions for introducing the concepts and building the model

Materials:
• Scissors
• Glue or tape
• Color pencils, crayons, or markers
• Cave pattern

Learn more about caves and karst: visit the NPS Cave and Karst Program www.nps.gov/caveandkarst/index.htm

U.S. Department of Interior
U.S. Geological Survey
National Park Service

Learning activities: “Growing Speleothems” and “Karst Topography Model.”

Evaluation of Cave and Karst Programs and Issues at U.S. National Parks

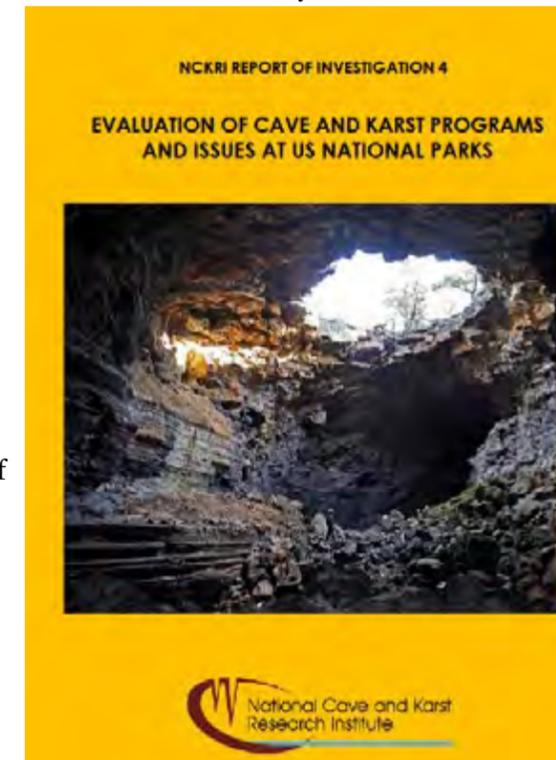
Submitted by George Veni, Executive Director, National Cave and Karst Research Institute

For nearly 30 years, I’ve enjoyed working in many capacities with several federal agencies on cave and karst research and management projects. Over those years there has been one recurrent theme, as we’ve talked about cave and karst agency needs, when I’d be told, “We really need to do that, but it isn’t seen as a priority.” In more recent years, I’ve been happy to hear such comments less frequently, and was delighted when Dale Pate asked the National Cave and Karst Research Institute (NCKRI) to conduct a survey of all NPS parks to identify their cave and karst needs so they could in fact be better recognized and prioritized.

The survey occurred in three steps: identification, outreach, and data analysis. With the help of Dan Doctor of the US Geological Survey (USGS), NCKRI compared all park boundaries with the latest version of the USGS’ national karst map, which was mostly complete but still in draft form at the time. From this GIS exercise, NCKRI quickly identified the majority of parks located on karst and pseudokarst. Manually reviewing the list of the remaining parks, we examined a variety of records to find other parks that were missed, usually because they contained unmapped pseudokarstic caves.

Our next step was to reach out to the identified parks by mail and e-mail, and ask them to complete an on-line survey. We also sent postcards to all 205 remaining parks informing them of the survey, saying we didn’t know of any caves or karst within their boundaries, but to notify us if they did and to complete the survey. We finally determined that 191 NPS park units contain or potentially contain caves, karst, or pseudokarst.

The on-line survey was divided



Cover of NCKRI report on Evaluation of Cave and Karst Programs and Issues at US National Parks.

into four parts: general information about the park and its caves and karst, cave and karst research at the park, cave and karst management efforts and issues at the park, and cave and karst education and interpretation at the park. Not all of the questions applied to each park. While we knew the survey was a bit long, it was the first survey done on the topic and we worked with NPS staff to make sure it asked enough relevant questions to guide the NPS in identifying and prioritizing its needs.

In the end, 28.3% of the parks with known or potential karst and pseudokarst responded to the survey. As the deadline for the report approached, we learned from cave and karst specialists at some parks that they never received the surveys. Unfortunately, it was too late to do much about it. In our final report, we noted the lack of response from some parks, not as a criticism, but to point out that some flaws exist that should be considered in future studies. In one case we know our e-mail was never received.

In other cases, we suspect that our outreach didn’t reach the right person or wasn’t delivered to the right person.

The detailed results of the survey are too many to repeat here, but some general observations deserve mention. We found that in a number of cases the survey may not have been completed by the most appropriate person, resulting in incomplete, inaccurate, or ambiguous responses. However, more than half of the park units that responded have no staff dedicated to management or research of cave or karst resources so in many cases there may simply have been no appropriate staff person available. In such cases the survey may have been completed by an overcommitted superintendent or office staff member with little time or resources to find the correct or complete responses to the survey questions.

We also found the lack of basic knowledge or understanding of the cave and karst resources at many park units as a striking and recurring aspect in all sections of the survey. This lack of information may reflect insufficient training for park staff, which again may result from limited staff and funding. Development of a liaison position

to facilitate communication among the research, management, and education divisions could significantly improve knowledge of karst resources within park units.

We recommended that the NPS consider additional and more focused surveys to enhance and follow on the results of this study, while studying our report to avoid its limitations. Several parks indicated that they were collaborating with external investigators, contractors, or volunteers to conduct research, education, or resource management within the parks. In many cases, solid science and education is being done because of these collaborative efforts. We believe such external support and collaboration may be critical to maintaining cave and karst management, research and education programs in the near future and should be supported whenever possible.

The results of the NCKRI survey were compiled into Excel spreadsheets to be easily updated and analyzed as needed. This survey is not meant as the final word on the subject but the first words of an exciting and improving story. If you work at a park that did not complete the survey, or if you wish to update the information on your park, contact Dale Pate at dale_pate@nps.gov. He will be happy to send you the survey and/or receive your updates.

NCKRI commends the NPS and its personnel on their efforts to improve their understanding, management, and interpretation of its cave and karst resources. Our full report, Evaluation of Cave and Karst Programs and Issues at US National Parks, is available for free download http://nckri.org/about_nckri/nckri_publications.htm as Report of Investigation 4 under the "Investigation Reports" menu bar.

Mammoth Cave NP Begins Public Scoping for Cave Management Plan

Submitted by Vickie Carson, Public Information Officer

Mammoth Cave National Park Acting Superintendent Russell Runge announced planning has begun for development of a cave management plan for the park. The park is now seeking public comment regarding the scope of the plan, June 2 through July 31, 2014.

"This plan will address how we manage the park caves," said Runge. "Research projects, construction and maintenance of tour trails, cave wildlife, and water quality are a few of the items that park staff have asked to be included in the scope of the plan. Now we are asking cave constituents and the public in general to give us their ideas."

As planning begins, park staff will compile a list of items and actions that need to be considered in the planning process; the list will comprise the scope of the plan.

BUFF Cave Research Foundation members get ready to launch on a beautiful May day. Photo by Sunny Farmahan.



"Comments from the public will help shape the cave management plan's development," said Runge.

In order to comply with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act, environmental documentation (an Environmental Assessment or an Environmental Impact Statement) will be completed.

The public scoping period will be open June 2 through July 31, 2014. The public may provide written comments about the scope of the project online at the National Park Service Planning, Environment, and Public Comment website at <http://parkplanning.nps.gov/maca>, or by letter to Mammoth Cave National Park, Attn: Ranger Larry Johnson, P.O. Box 7, Mammoth Cave, KY 42259.

Comments are typically treated as public record and made available for public review. Individuals may request that the National Park Service withhold their name and address from disclosure. Such requests will be honored to the extent allowable by law.

Park Updates

Carlsbad Caverns National Park

Submitted by Stan Allison and Shawn Thomas

Cave Exploration, Survey & Cartography Lechuguilla Cave

Peter Bosted led a ten person trip to the Western Branch of Lechuguilla in December 2013. Most of the trip was focused in four areas: Oz, Southern Climes, Outpost of the Wild-Wild West, and the Hard Daze Night Hall. About 2500' of new passage was surveyed, with another 1280' of replacement survey, and about 700' of re-survey without sketches to fix bad loops.

Carlsbad Cavern

In February 2014 Ed Klausner continued his project resurveying the Big Room and Lower Cave. With the Big Room completed, Ed is now focusing his efforts on Lower Cave. Ed will return in the fall to resume the project. Also in February, Derek Bristol and Shawn Thomas

returned to Halloween Hall, along with Pete Johnson and Garrett Jorgensen. The room ended, as did the 80' tall dome that Derek climbed. The team completed a detailed sketch and mineral/biological inventory of the room. This trip officially finalized the exploration and survey of the Spirit World.

Slaughter Canyon Cave

In February, 2014, Dave West contin-

ued his project resurveying Slaughter Canyon Cave. Dave is nearly finished with the resurvey, with the exception of some high leads in the cave, which he plans to explore using a ladder. Dave will return in the fall to resume the project.

Spider Cave

In April 2014 Paul Burger led three trips to the recently discovered Gilead section of Spider Cave. Over one thousand feet of cave was surveyed bringing Spider Cave up to 5.50 miles. The highlight of the trip was finding a western extension of Eyebolt Canyon that enlarged the cave's footprint. Paul updated his Spider Cave map within weeks of the trips.

Ogle Cave

Over the winter, Shawn Thomas and Stan Allison led a series of trip to complete the resurvey of Ogle Cave, which was initiated in 1999. On the final trip in May, the team mopped up the remaining leads and even managed to survey a minor amount of virgin cave, which was unexpected in a cave with over one-hundred years of history

Buffalo National River

Submitted by Kayla Sapkota

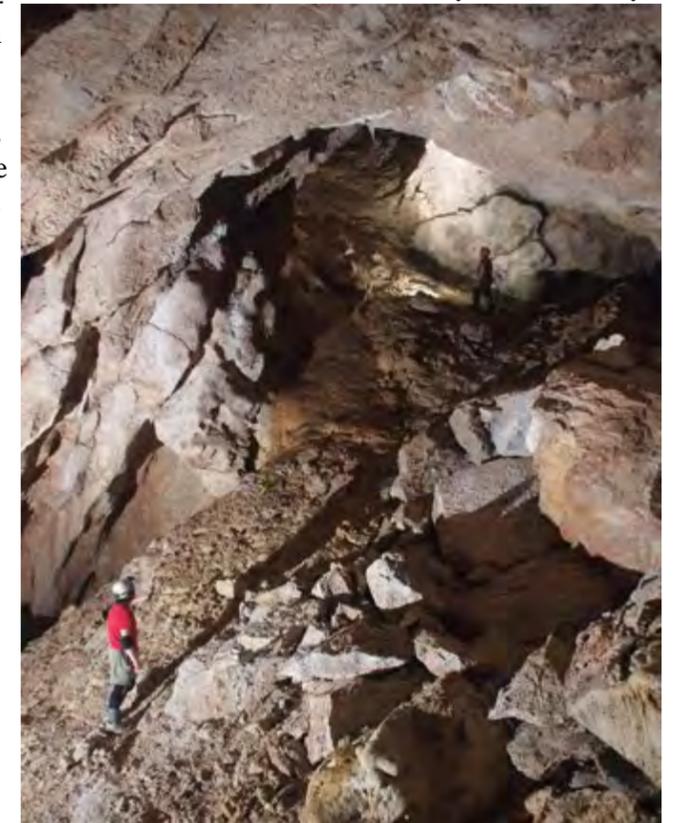
The Ozarks Operations of the Cave Research Foundation has been focused on cave research in the Big Creek tributary and the Middle District of the Buffalo National River. This section is located downstream from a recently constructed Concentrated Animal Feeding Operation, which has been a source of concern for Park personnel.

Twenty-three Cave Research Foundation volunteers floated the Buffalo National River to focus on sections for monitoring for disturbance as well as checking dyepackets from the hydrologists' recent work. Additionally, four known caves were biologically monitored and surveyed, and three new caves were located.

Work has continued concerning the survey of a series of small caves located immediately on Big Creek with a crew visiting a cave known as Tom Barnes Cave and locating another several hundred feet of very low, wet crawling. A dye packet was placed about 300 feet into the cave for tracing.

On-going monitoring and survey projects will continue in the Big Creek tributary area in the coming months.

The recently discovered Halloween Hall area in the Spirit World above the Big Room. NPS photo by Shawn Thomas.



dating back to the guano mining era. The cave still contains high leads that will require major climbing efforts to access; otherwise, the resurvey project is considered complete. Paul Burger has drafted an excellent map and will be displaying in the Cartographic Salon at the 2014 NSS Convention.

Cave Restoration

William Tucker of the Cave Research Foundation continues to lead work on several restoration projects in the Big Room. Last year, the group completed restoration of a dry pool basin adjacent to the trail that had become tracked with red clay. Restoration is now focused on cleaning flowstone and pools at two sites on the far side of the Big Room, including Mirror Lake. William and crew will be spending a week in June working on these projects.

In March, 2014, members of the Central Oklahoma Grotto (COG) traveled to the park to perform maintenance of the mesh tarps they custom made in the mid-2000s to catch debris dropped into the National Geographic Pit, that connects between the Big Room and Lower Cave. COG members also assisted with trail cleaning and flagging in Lower Cave.

Cave Research Activities

In May 2014 Dave Decker, a PhD candidate in the Department of Earth & Planetary Sciences at University of New Mexico, collected his final set of spar (dogtooth calcite) samples from two backcountry caves in Carlsbad Caverns National Park. These sites were chosen to fill in a sampling gap across his area of study. Dave is nearing completion of his thesis and has three papers in the works to be published over the next year or so, including some exciting new theories on the genesis of the Guadalupe Mountains and associated

cave and karst development.

In February 2014 Diana Northup returned with students to study the microbiology of Spider Cave. This trip included the first microbiological samples taken from Gilead.

In April 2014 Art and Peg Palmer returned to study late stage events in Guadalupe Mountain caves. They made several trips in Carlsbad Cavern and Spider Cave.

White-Nose Syndrome (WNS) Funding

Like most NPS cave parks, Carlsbad Caverns received funding in FY2014 for projects related to bats and WNS. With the bulk of the funding, the park is finalizing an agreement with Diana Northup and Debbie Buecher to conduct microflora analysis of *Myotis* species by swabbing the skin and fur of captured bats. The project will also include additional soil and substrate sampling to test for the presence of *Pseudogymnoascus destructans*. The remainder of the funding is being used to award a contract for replacing cave gates on Slaughter Canyon Cave to restore natural airflow conditions and allow wildlife access.

Cave Rescue Training

Stan Allison and Shawn Thomas attended the National Cave Rescue Commission (NCRC) training held in Divide, Colorado in May. Stan completed TOFE (Team Operations and Field Exercises) and Shawn completed Level 3. It was an excellent week of training and a good opportunity to interact with other NPS cave resource employees and cavers from around the country. The mock rescue was a highlight, with a particularly exciting conclusion when lightning storms and potential flooding forced a hasty evacuation from Williams Canyon. It was definitely

a “for real” situation.

Park Filming

In May, Stan Allison and Shawn Thomas assisted a filming crew from Indigo Films, who visited the park to film an episode of the Travel Channel’s “World Access” program. The episode will feature the program host being accompanied by Stan and Shawn to visit portions of Carlsbad Cavern and a vertical caving trip to Chimney Cave. The episode is expected to air this fall.

Cavern Lighting Project

The Cavern Lighting project continues with approximately 60,000 feet of new wire installed to date along with several new transformers. Lessons learned from this project include that using a categorical exclusion for compliance is inappropriate for a project of this scope. An Environmental Assessment should have been done due to the amount of new impacts caused by this project. The Park is working closely with the New Mexico State Historic Preservation Office to mitigate some of the visual impacts caused by this project.

Cave Resources Office Staffing Changes

Shawn Thomas has accepted a new position with Bat Conservation International (BCI) in Flagstaff, AZ. Shawn will be the Assistant Director of BCI’s Subterranean Program, coordinating bat surveys in caves and mines. Shawn’s last day with the park will be July 11. Shawn has done an excellent job for Carlsbad Caverns National Park and his expertise and good attitude will be missed. We wish him all of the best in his new position.

Grand Canyon National Park

Submitted by Cynthia Valle

Hydrology Program Management

Grand Canyon National Park (GRCA) is currently updating its Backcountry Management Plan (BMP). Karst resources such as springs, seeps, and sinkholes are addressed under the Water Resources sections and the report addresses the need for a Grand Canyon Cave Management Plan. The park welcomes Rissy Kelly, our seasonal Cave Research Assistant, who will be focusing on developing a draft Cave Management Plan through the Greater Grand Canyon Land Assessment (GGCLA). Grand Canyon National Park is also excited to welcome Ben Tobin as the permanent Park Hydrologist. Ben will commence on June 30, 2014, and be duty stationed in Flagstaff, Arizona.

Monitoring & Data

Grand Canyon currently has 31 instrumented backcountry sites with continuous loggers collecting data such as water level, temperature, and conductivity at stream caves, plateau springs and associated perennial creeks, and springs along the mainstem Colorado River. In accordance to past research showing that the Kaibab Plateau’s high discharge springs are highly dependent on snowmelt, the Park’s drinking source, Roaring Springs, as well as most other North Rim springs, have been below base flow during the entire 2014 peak flow season due to the lack of snowpack this winter.

Through the GGCLA, Grand Canyon has been able to collaborate with Springs Stewardship Institute (SSI) of Museum of Northern Ari-

zona, to improve our springs database. Grand Canyon also participated on the Guides Training Seminar River Trip this spring, and with SSI was able to add several more spring and seep sites, for a current total of 800 spring sites within Grand Canyon NP. With Lidar data provided by Kaibab National Forest, our sinkhole database has been updated to now include 4532 sinkholes in the Grand Canyon region. The next step is to have volunteer groups go out and field confirm and inventory these sites.

Great Basin National Park

Submitted by Gretchen Baker, Gorden Bell, and Ben Roberts

In March, Great Basin National Park hosted a lint and restoration camp. Thirty-seven participants spent a total of 800 hours and moved over two tons of debris from the cave and cleaned 600 linear feet of passage. Much of the debris came from old trail material, particularly sand. Several rimstone dams and other cave features were uncovered. The interagency effort with U.S. Forest Service and BLM attendees was also supported by the Western Cave Conservancy, a group dedicated to protecting caves



Interpretive park ranger Lucinda Turbeville visits the Behman Annex, an off-trail portion of Lehman Cave, on the Lehman Cave quarterly biomonitoring survey. NPS photo by Gretchen Baker.

in the western US. Half the participants were under age 25, and some of the participants were fulfilling school community service projects. We had both cavers and non-cavers participate, representing California, Utah, Idaho, and Nevada. The NPS Cave and Karst Program Manager, Dale Pate, also assisted with the restoration, as well as provided technical assistance to the park on how to reduce the amount of lint and debris entering the cave.

Identification of paleontological finds in the caves continues. Park staff are continuing to process and identify Pleistocene fossils from Snake Creek Cave. During the summer we excavated 3 additional small pits in the rear of the cave and washed the recovered material. Some of the new finds from that

work include several American pronghorn teeth (pronghorns are rarely seen in the canyon today) and one porcupine tooth. The single porcupine tooth is the only one found so far in the cave and suggests that perhaps porcupines were just as uncommon in the Snake Range during the Pleistocene as they are today.

The park is planning WNS projects, including enhanced interpretive displays, bat monitoring, and updating equipment.

Park staff are working with NSS 2016 Convention staff to relocate areas of the cave photographed in 1928 so that Dave Bunnell can re-photograph them. The 1928 photos were discovered in the Library of Congress and are not currently in the park archives. The names for some of the cave formations have changed over the years. It is likely that the new photographs will also reveal some other changes.

Park staff welcomed Timpanogos Cave staff for a visit through Lehman Cave. Maintenance, interpretation, and resource management staff met their counterparts and shared ideas.

Resource management staff took interpretation and law enforcement staff on trips into caves to orient them to the caving environment and to help conduct various resource management projects, including on Lehman Cave quarterly biomonitoring surveys, downloading data loggers, and conducting water quality. The interdivisional cooperation is extremely helpful because of the limited number of area cavers. The annual Lehman Cave rescue practice, held in May, also involved several park divisions. The park has also been asking assistance from the Northern Nevada Grotto on cave projects to help develop that relationship.

Paleoclimate researchers Matthew Lachniet, Rhawn Denniston and others published an article in Nature Communications in May that included data from three Lehman Cave stalagmites. The record, coupled with two other stalagmites from two other caves, goes back 175,000 years and helps define Great Basin climate for that time period better. The paper also goes on to predict that the reappearance of large lakes in the Great Basin (like Lake Bonneville) is unlikely for the next 55,000 years. [This UNLV press release](#) goes into more details.

Lehman Cave received positive press when nature and science reporter John Hollenhorst from KSL News in Salt Lake City filmed a story focusing on climate change and scientific research that aired in April, entitled "[Lehman Caves: Time capsule of nature etched in stone and bone.](#)" An accompanying article appeared in the Desert News with the title "[Glorious national park 'basement' is science wonderland.](#)"



Thirty-seven participants helped clean lint and remove over 2,000 pounds of sand and debris from Lehman Caves in March. NPS photo by Dustin Shalue.

Jewel Cave National Monument

Submitted by Dan Austin

Cave Exploration

Even though the pace of exploration has slowed in the last few months, more than a mile of new passage has been added to the cave's length since the last update. Promising leads that Chris Pelczarski was pushing along the eastern edge of the Calorie Section eventually ended in alcoves or too tight fissures, forcing him to look elsewhere. Chris backed up and recently started leading trips closer to the entrance. One such trip to the \$ survey in the Main part of the cave, less than 20 minutes from the elevator yielded 759 feet of virgin passage surrounded by known cave. This new area, while highly decorated with brilliant yellow flowstone and pools, was covered in a dense coating of manganese that is so prevalent in Jewel. Chris dubbed the area the Manganese Mansion.

In March, Chris joined forces with Rene Ohms and Dan Austin to push leads in the far western

branch of the cave. Before arriving at their designated leads, the trio stopped at a remote water collection site near Coyote Flats to update the water collector. Previously, this water collector had a 2 gallon capacity, not nearly enough to sustain a team of cavers on a longer day trip. Since exploration trips to this area routinely last more than 16 hours, with an 8 to 10-hour round-trip commute to the leads, it was decided that not only would more water be beneficial for exploration trips, but also in the event that a rescue were to occur in this remote part of the cave. The new water collector mimics a design already in use in the southeastern part of the cave, and utilizes three 5-gallon collapsible jugs for a total capacity

of 15 gallons. It is anticipated that another 5 gallons will be added to the system at a future date. On the same trip, Dan, Rene and Chris surveyed into a passage heading southwest off the edge of the map with definite airflow.

They ran out of time, but left two walking-sized narrow fissures continuing southwest. The floor of this entire area was covered with thin gypsum slivers, and the new discovery was called the Southwest Splinter. A return trip to the area is planned for June.

A much-anticipated return trip traveled back to Hidden Loft in May. The last trip to Hidden Loft

in November of last year surveyed 1,168 feet of virgin passage, leaving at least a dozen leads left to check. Jen Foote drove from New Mexico and Hilary Fischer from Colorado to join Lydia Austin and Dan Austin on the return survey trip. Much of the effort on this return trip was focused on the half-dozen walking sized leads in the area. Unfortunately, all of these eventually ended, but the team managed to survey over 780 feet before calling it quits. The Hidden Loft area now contains 2,873 feet of passage that has been surveyed since August of 2013. Many of the remaining leads in the area can now only be accessed through a very tight hole called the Vocal Struggle, suitable for only very small individuals.



Dan Austin, Lydia Austin, Hilary Fischer, and Jen Foote survey Jewel Cave's 170th mile. NPS photo.

Park management continues to be amazed at how much new passage is still being found within an hour of the entrance. The Hidden Loft trip in May brought the total length of Jewel Cave to 170.05 miles.

Current Projects

Cave management staff have been working diligently to complete a project to install a series of bat-cams in the historic entrance to the

cave. The bat-cams will be aimed at the winter hibernaculum roost of the Townsend's Big Eared Bat (*Corynorhinus townsendii*), and will give the park a better idea of winter bat behavioral patterns of all the species roosting in the cave with minimal or zero disturbance from humans. This past winter, the park counted 1,062 bats in the historic area, 466 of which were Townsend's. The National Cave and Karst Research Institute in Carlsbad, New Mexico has agreed to host the bat-cam feed for the park when completed. The project has been in the works for some years, but should be completed by the end of the fiscal year.

While much of the subsurface activity in the park has seen slower

progress, the above-ground projects have been happening at a rapid pace. In April, two large construction projects were begun that have incorporated elements that help to protect the cave from surface runoff and contaminant infiltration.

Highway 16 is currently being rebuilt through the

monument, with some of the sharper bends in the road being straightened for safety reasons. During the planning stages for this project, the park requested that the highway department incorporate catchment basins into their design to help prevent runoff from high-flow events from creating resource damage both to the surface and to the cave below. Filter media will be installed in the basins to remove

hydrocarbons and other chemicals that would unnecessarily impact the cave environment, and park personnel will be responsible for replacing and maintaining the filters at regular intervals.

Similarly, the visitor center parking lot has been slated for reconstruction for many years, and construction has now begun. The new lot design incorporates a catchment tank and filtration system that will reduce the amount of hydrocarbons or other unnatural compounds entering the cave directly below. It is anticipated that the new design will not only help to minimize impact to the cave, but also to ease traffic flow issues and congestion that has arisen in the last few decades from increased visitation.

Lava Beds National Monument

Submitted by Katrina Smith

Lower levels of Fleener's Chimneys blocked once again

Fleener's Chimneys are a group of spatter vents associated with the Devil's Homestead Flow, a 12,000 year old a'a flow on the northwest side of the monument. The deepest of these chimneys was excavated during a 1992 CRF project that removed hundreds of pounds of rocks and debris thrown in by visitors over the years, and yielded a 50-foot deep chimney with continuing lower passages, complete with historic graffiti and unique mineralization.

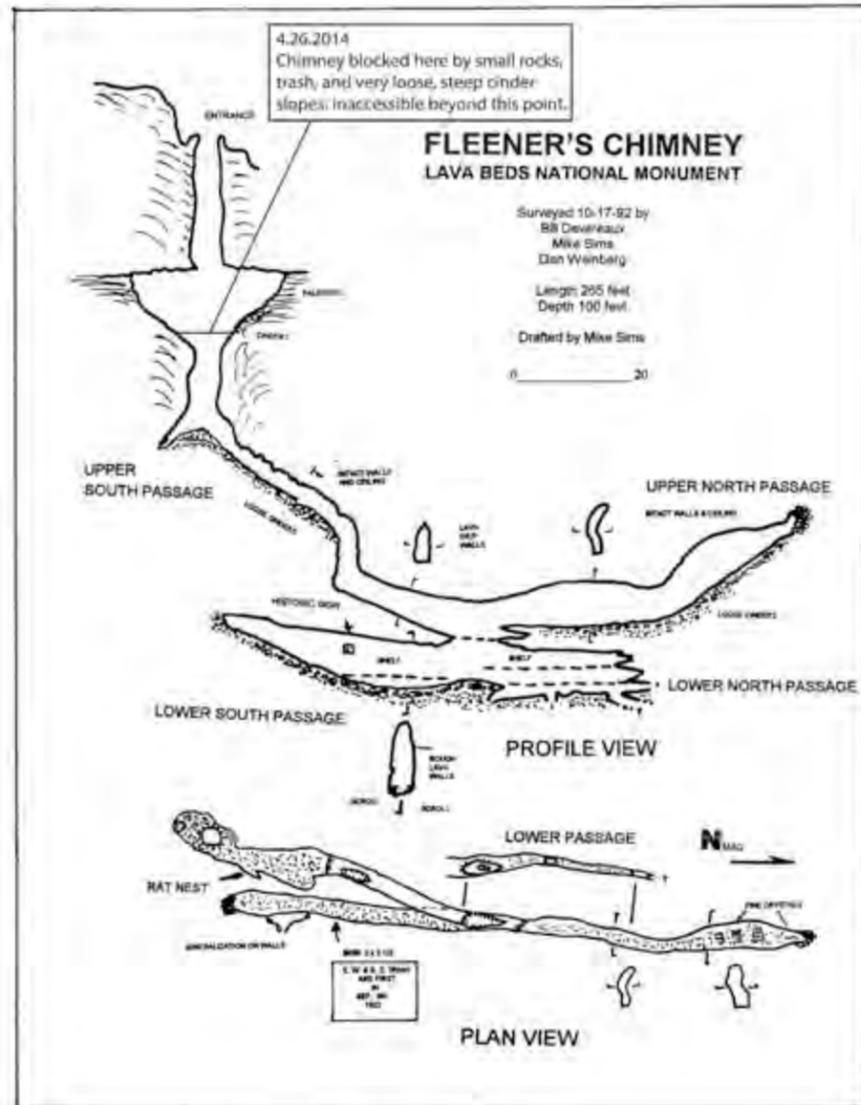
On April 26, 2014, Lava Beds staff attempted a descent into Fleener's Chimneys to assess the past two decades of accumulated trash and debris and to photograph current conditions and interesting features. Katrina Smith, Physical Science

Technician, and Jesse Barden, Park Guide, rappelled down but reached the bottom of the pit only 35 feet below the surface, standing on a small pile of fist-sized rocks, surrounded on all sides by very steep, loose red-orange cinder slopes. Some trash was mixed in with the rocks directly below the

full of loose cinder up to this point, or whether some large blockage occurred below this point, leaving the levels beneath the blockage open but inaccessible.

Revision of long-term cave monitoring protocol

In 2012, Lava Beds began imple-



Map of Fleener's Chimney, drafted in 1992, with the blocked passage noted as it was found in April 2014.

chimney entrance, indicating a potentially anthropogenic blockage of the chimney, but the loose cinder slopes immediately slid in behind any rocks or trash that were removed, indicating some level of natural blockage as well. It is uncertain whether the lower levels are

menting the Klamath Inventory and Monitoring Network's Cave Entrance Community and Cave Ecosystem long-term monitoring protocol. Seven parameters are measured to assess the overall condition of thirty-one caves within the monument. Field test-



Katrina Smith and Megan Mason, Physical Science Technicians, discuss data collection while monitoring the ice floor in Skull Cave. Photo by Jean Krejca.

ing and revision of methods for many of these protocols has been challenging, but the goal is to have revisions completed by the end of this summer season. Outside assistance from Jean Krejca at Zara Environmental, LLC was greatly appreciated during the week of May 12th, when she and Klamath Network staff visited LABE to work through protocol issues in the field with LABE staff. June will mark the beginning of the second cycle of vegetation, invertebrate, scat/organic material, climate, and visitation monitoring. Other parameters measured during the off-season include ice/water and bats.

Ice cave monitoring and conference attendance

As part of the Klamath Inventory and Monitoring Network's long-term cave monitoring protocol, LABE staff has been working diligently to create and refine monitoring plots and methods to evaluate the changes in area and level of ice floors within five caves that contain the majority of the monument's cave ice resources. This monitoring is especially of interest as many

Idaho Falls in August 2014.

Hibernacula surveys

This year's hibernacula surveys were more extensive than ever, covering a lot of ground and thoroughly testing the stratified random sampling method created for LABE by Shawn Thomas and Ted Weller for the second year in a row. In 2014, surveys were conducted from January 20-28 by a combination of qualified NPS and other agency staff and volunteers totaling fourteen people. Over this unseasonably warm week with 50°F average high temperatures, 78 caves were surveyed and 1447 Townsend's big-eared bats (*Corynorhinus townsendii*) were counted. Thirteen *Myotis* sp. and four big brown bats (*Eptesicus fuscus*) were also observed during these surveys. These numbers compare well with the past few years when pilot and final versions of the protocol were implemented, suggesting that the monument's bat population is stable and in good health.

caves are losing their ice resources, some more quickly than others. Caldwell Ice Cave is currently showing the most dramatic change; a 1 ft x 2 ft hole in the ice floor first observed in 2011 has tripled in size in just three years. In addition, the level of the entire floor has dropped approximately 1 foot in the past two years. LABE staff will be presenting ice monitoring methods and initial results at the International Workshop on Ice Caves in



The largest cluster of Townsend's big-eared bats observed during the 2014 LABE hibernacula surveys, totaling 47 bats. NPS photo.

Mammoth Cave National Park

Submitted by Rick Olson

Bats and Vats: Cave Environmental Restoration in the Historic Section of Mammoth Cave

Environmental restoration work in the Historic Section of Mammoth Cave has been ongoing since March 1, 1996 when I finally obtained permission to install Plexiglas panels on the open grid gate, over two years after the 40 ton slab fell from the ceiling of the Rotunda. This action was taken to restore the influx of cold winter air to approximately what it would have been before alterations to Houchins Narrows began in the early 1800s. Even with installation of open-grid stairs and removal of a concrete plug in Crevice Pit in 2004, restoration of winter temperatures in Little Bat Avenue has been limited by a condensation problem at Booth's Amphitheater, which causes water to drip on the second set of saltpeter vats from the War of 1812.

To achieve a simultaneous solution (i.e. conservation of vats and bats), an extensive network of environmental sensors is being deployed to support sophisticated fluid dynamics modelling (Toomey & Olson 2012). A somewhat novel option to remedy the situation would be to trench through the artificial fill at Booth's Amphitheater as an archaeological dig to create a channel for cold air to pass more naturally. This would be covered by an insulated boardwalk at the current trail level with open stairs at each end to allow cold air to pass without interacting with warmer moist air coming out of Gothic Avenue. If the fluid dynamics modelling supports creating a cold air pass to protect the saltpeter vats, then Archaeologist George Crothers has indicated he would not oppose this idea.

Airflow restoration in a nearby passage will also potentially be supported by this fluid dynamics modelling. At Vespertilio Hall there was a major Indiana bat hibernation site cooled by an opening to the surface at the end of Olive's Bower. Here is a quote from Hovey & Call (1897): "Thousands of bats in the winter season, suspended in great clumps, may be seen. A single catch one night gave the writer six hundred and seventy individuals, most of which went to the United States National museum." Evidence including this historical account and geological aspects of this passage were summarized in a white paper for park staff with a recommendation to consider reopening this connection to the surface (Olson & Toomey 2005).

Timpanogos Cave National Monument

Submitted by Cami McKinney

Timpanogos Cave National Monument began regular water quality sampling of Hansen and Hidden Lakes in 2007 utilizing protocols for the Northern Colorado Plateau Network (NCPN) partnership. The park wished to begin sampling cave waters to create a baseline and for looking at potential contaminants and variance between a water source near the tourist trail (Hidden Lake) and in a less disturbed area (Hansen Lake).

Cave waters have proven to be very different from surface water collecting and sampling. After a few years of evaluation and modification, the last few years the program is able to be successful and produce valuable data. Water quality monitoring looks at pH, nutrients, dissolved oxygen, and conductivity as well as periodic sampling for metals, bacteria, and other potential contaminants. While the

majority of sampling is showing near-pristine waters in the caves, EPA offered to include Middle Cave Lake in a contaminants of emerging concern sampling program in the NCPN parks. Early samples in 2010 and 2011 identified compounds such as pesticides, pharmaceuticals, personal care products, and other wastewater indicators – all pollutants not traditionally tested for during water quality sampling.

In 2014, USGS biologists with the Toxics Program have taken an interest in this project and begun sampling Middle Cave Lake sediments for the occurrence of these contaminants on the lake floor to determine the persistence of these contaminants and the potential ecological/toxicological impacts to the cave environment. Results from this study will continue into next season.

Wind Cave National Park

Submitted by Rodney D. Horrocks

Projects

We just completed construction on the new airlock structure on the Walk-In Entrance of Wind Cave (See accompanying photo). This structure, which can hold 40 people comfortably, replaced the old leaky revolving door. The old door leaked half as much air as passed through the Natural Entrance and it allowed wood rats and bats to use that artificial entrance. This new airlock has created a nearly perfect seal and also allows visitors' eyes to adjust to dim conditions before they head down the steep entrance stairs.

Rod recently completed a map of the Historic Section of Wind Cave that shows the relationship between the parking lot, visitor

center, tour routes, and off-trail cave passages. This new map was added to the park's 2014 season newspaper.

Bats

As anticipated, bats came out of hibernation in Wind Cave this spring and tried to get out of the revolving door that they had entered the cave through the previous fall. Not being able to get out through the new airlock structure, which replaced the revolving door, we found that they

odes), Western long-eared bat (*Myotis evotis*), and Little Brown myotis (*Myotis lucifugus*). This was the first appearance of the tri-colored bat in the park. With this new addition to our park list, we have now documented 12 bat species, all of the species that have been reported from the Black Hills. At this point, there are still a few bats that have crawled into small cracks near the Walk-In Entrance that we haven't been able to remove from the cave. We had only expected to

a hibernaculum, as we don't think they will use the Natural Entrance due to its small size, vertical nature, and strong winds; however, we will attempt to verify that this is indeed the case.

Research

Marc Ohms recently completed compliance on a project to dig open a blowhole he discovered in 2003, which he named Persistence Cave. The blowhole which is located near the top of the Pahasapa



The recently completed airlock structure on the Walk-In Entrance of Wind Cave. Coconut fiber soil retention matting was placed on the dirt that partially covers the new structure. Photo by Rod Horrocks.

would go back into torpor in the vestibule before the inside door. We have been capturing and removing small groups of these bats from the cave (1-5 individuals at a time) on a daily basis since April 23. We have now removed 51 bats from the cave, which includes five species, including: the Tri-colored bat (*Perimyotis subflavus*), Northern long-eared bat (*Myotis septentrionalis*), Fringed myotis (*Myotis thysan-*

capture between 10-20 bats this spring, so we were surprised at the number of bats that were using Wind Cave as a hibernaculum. Apparently, we underestimated the numbers because they come out of the cave over a six week period in small numbers that we had never noticed before. However, with the completion of the new airlock, we anticipate that bats will no longer use Wind Cave as a day roost or as

Limestone, is about 1,800 feet from the known edge of Wind Cave. Dr. Andreas Pflitsch has collected several years of data from the site and has determined that the airflow from this blowhole is related to Wind Cave. The cave was a former snake den that has thick deposits of sediment, gravel, and bones on the floor. Dr. Jim Meade from East Tennessee State University will be supervising a paleo excavation of

these sediments.

We just documented a new paleo site in Wind Cave. It was originally discovered by Marc Ohms near the Juice Room in the Historic Section in 2012. Rod used a Hot Springs High School volunteer named Gabe Davila to help him document and flag the new site. Gabe named the site The Dripping Dome Site.

Personnel

Kim Acker volunteered for the Physical Science office over the winter. She primarily helped with the cave resurvey project and various work trips into Wind Cave.

Dan Austin, from Jewel Cave National Monument is again working one day a week for us. He is primarily working on the new digital section maps of Wind Cave.

Cave Survey

Since the last reported length of the Wind Cave survey in Inside Earth, cavers have increased the surveyed length of the cave by 1.43 miles; establishing the current length of 142.43 miles, which maintains its standing as the sixth longest cave in the world. According to the COMPASS software, the Wind Cave survey now contains 2,506 loops and 42,206 stations, with an average shot length of 17 feet.

For the first time in three years, Carl Bern from Colorado recently led a camp trip back to Camp Cosmos in the Southern Comfort Section of Wind Cave. They were able to push a flowstone-covered lead near the Deep End by using Tyvek white suits and white-soled Aquasocks and changing their clothes on a sheet of plastic located in front of the lead. They were able to survey the flowstone-covered passage, which they named the Bobsled Run, for 161 feet to a dead end and a new lake, which they named

The Last Splash. After surveying a couple more crawls, Carl decided to call the trip a day early.

A new in-cave rescue cache was installed in the Coke Room. David Lambert from Colorado led this effort and the Colorado Grotto funded most of the supplies. Now each of the major flagged travel routes has a rescue cache.

Sign Written by Tribes Installed at Natural Entrance

Submitted by Tom Farrell

A recently installed sign at the Natural Entrance to Wind Cave



Gabe Davila and Rod Horrocks work on documenting mammal bones at the new Dripping Dome paleo site in Wind Cave. Photo by Rod Horrocks.

was developed by representatives of American Indian tribes. The sign was a result of five consultation meetings dating back to 2006 held between the park and tribes with cultural or historical ties to Wind Cave.

“We are very pleased with the results of this process,” said park Superintendent Vidal Dávila. “The former sign was historically inaccurate and culturally insensitive. The park removed it in 2006. This new sign tells the story of the significance of this opening in the words

of the indigenous people.”

Along with choosing the graphics for the sign, the text was written by tribal members. The National Park Service helped with the layout, but otherwise the sign was entirely developed by the tribal representatives. Four of the consultation meetings were held at Wind Cave National Park and one was held on the reservation for the Rosebud Sioux Tribe.

Dávila said, “These meetings improved our understanding of their cultures and developed relationships that we intend to use on future projects.”

The sign, posted over Wind Cave’s Natural Entrance, will be seen by an estimated 65,000 people annually.



Wind Cave National Park's new sign at its Natural Entrance was developed by tribal representatives. NPS Photo.

Mark your calendar! The deadline for the 2014 Winter issue of Inside Earth is October 1, 2014.



**National Park Service
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