	Monday	Tuesday	Wednesday	Thursday	Friday
9:00	Project Underground 9:00 am – 12:00 pm	Crumps Cave Preserve; A Unique Case of Acquisition and Management of a Cave System for Karst Research - Benjamin V. Miller	Timpanogos Cave National Monument Field Trip 9:00 am – 4:00 pm	White-Nose Syndrome: The State of Knowledge and Management in 2011 - Jeremy T. H. Coleman	The Role Interpretation and Volunteers Play In Cave Resource Protection - Dawn Ryan
9:20		Management Guidelines for Caves and Karst in Parks Canada's Heritage Areas – Greg Horne			Volunteer Recognition: What We Can Do for Them? - Bonny Armstrong & Jim Goodbar
9:40		Lincoln National Forest Revises a Cave Management Program - Jason Walz		White-Nose Syndrome & The Ivory Billed Woodpecker - Tom Aley	Techniques for Incorporating Karst/Cave Science in Cave Guide Training - Patricia Kambesis
10:00		Diverse Cave and Karst Resource Management on the Tongass National Forest - Johanna L. Kovarik		The U.S. National Park Service Response To White-Nose Syndrome In Bats - Kevin T. Castle	Comparison of Cave Gate Materials – Jim "Crash" Kennedy
10:20		Break		Break	Break
10:40		Cave and Karst Resources in West-Central Florida, USA: Implications for Management, Education, and Research - Jason S. Polk		Implementing an Effective White-Nose Syndrome Screening Strategy at Lava Beds National Monument - Shane Fryer	Combining Teenagers, Cave Monitoring, and ArcGIS - Brennen Shaw, Sandi Baker, and Katie LaFeaver
11:00		Powell Mountain Karst Preserve: Strategies for the Permanent Protection of Omega Cave and Related Karst and Surface Resources - Joey Fagan		The Utah Bat Conservation Cooperative - a Statewide Framework for Bat Management - Kimberly Hersey	Building a Successful Trip Leader Training Program - Andy Armstrong
11:20		The Gating of Eagle Creek Bat Cave, Arizona – Tom Gilleland		Bats at the Boy Scout Jamboree - An Outreach Event for Bat Education - Carol Zokaites	Cave Rescue Pre-Planning at Wind and Jewel Caves, South Dakota – Rene Ohms
11:40		The Geography of Karst - James E. Kaufmann		Building a diversified monitoring program for cave-dwelling bat species – Shawn Thomas	Cave and karst area within the new expansion to Nahanni National Park - Greg Horne
Noon	Lunch	Lunch		Lunch	
1:00	Bat Cave Assessment & Management by BCI 1:00 pm – 5:00 pm	The Role of the National Cave and Karst Research Institute in Cave and Karst Management - George Veni	Logan Canyon Field Trip 8:00 am – 5:00 pm	Bat Surveys, Bat Gates and Radiation - Bats in Utah Abandoned Mines 1995-2010 - Anthony A. Gallegos	
1:20		Cave and Karst Resources Evaluation for Long-term Protection and Conservation - Dale L. Pate		How Resilient Are Cave Ecosystems To Climate Change And Fire Suppression? - Emily Ring	
1:40		Caves & Karst of the Providence Mountains Study Area, Mojave National Preserve: Building Upon Decades of Volunteer Contributions - Bernard W. Szukalski		The Northern Karst Socio-Ecological Transect - Miriam Toro Rosario	
2:00		Current Cave Management Projects at Jewel Cave National Monument, South Dakota – Mike Wiles		Biodiversity in High-Elevation Caves in Great Basin National Park - Gretchen Baker	
2:20	Vertical Workshop 1:00 pm – 5:00 pm	The Relationship of Recent Geologic Features to the Origin of Jewel Cave, South Dakota – Mike Wiles		A Long-Term Strategy for Monitoring Biotic and Abiotic Parameters in Caves of the Klamath Region - Jean Krejca	
2:40		Update on the Development of the NPS Vital Signs Monitoring Protocol for Cave Visitor Impact – Rodney D. Horrocks		Ongoing Conservation Efforts to Protect the Foushee cavesnail, *Amnicola cora* (Hydrobiidae) - Michael E. Slay	
3:00		Break		Break	
3:20		Lehman Cave Restoration Project – Ben Roberts		Population Monitoring of Illinois' State Endangered Enigmatic Cavesnail (Hydrobiidae) – Steve Taylor	
3:40		34 Year Photo Comparison Project in Spanish Moss Cave, Utah – Adam Leavitt & Michael Leavitt		Bait Box Survey of Aquatic Invertebrates for Four Caves in Glacier National Park - Ernie Cottle	
4:00		Manual Cave Management Nightmare or Automated Website Tranquillity in Nutty Putty Cave, Utah – Michael Leavitt		Variation of $\delta^{18}O$ and $\delta^{2}H$ in the Carbonate Aquifers of the Cumberland Plateau in Southeast Kentucky – Lee Florea	
4:20		Studying Cave Visitation Trends – Jon Jasper		Seasonal Variation of Carbon Dioxide in Oregon Caves - Elizabeth Hale	
4:40		Alpine Karst In Utah - Lawrence E. Spangler		Groundwater Development May Harm National Park Caves - Gretchen Baker	
Evening	Howdy Party 6 pm – 9 pm	Poster Session 5 pm – 6 pm		Banquet 7 pm – 9 pm	

Crumps Cave Preserve; A Unique Case of Acquisition and Management of a Cave System for Karst Research

Benjamin V. Miller, Christopher G. Groves, Jason Polk, Patricia Kambesis
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Crumps Cave is a 2 km-long cave located on the Pennyroyal Sinkhole Plain of south-central Kentucky. The cave, briefly developed as a private show cave, is known for archaeological and speleological significance. A process was initiated in 2007-08 to acquire the cave for research and education/outreach, by the Hoffman Environmental Research Institute at Western Kentucky University (WKU). A grant was awarded by the Kentucky Land Heritage Fund to WKU and the five acres encompassing the entrance sinkhole was acquired. Following this acquisition several inventories were conducted examining the archaeological and biospeleological resources, in addition to surface flora and fauna. Management decisions for the cave and preserve are discussed and carried out by a three member management team comprised of WKU faculty and staff. Today the cave is a major site for hydrogeologic research, where impacts from surrounding agricultural operations are studied at several epikarstic waterfalls interspersed throughout the cave. Monitoring of the environment in and around the cave is gathered from a series of five dataloggers measuring over 22 parameters. The cave is also being utilized as an underground classroom which is visited by WKU classes in the disciplines of geology/geography, archaeology, and biology. Recently the remains of a lighting system and 600 feet of boardwalk were removed in a cooperative effort between several NSS grottos and WKU. Crumps Cave Preserve will continue to be a site available for use in a variety of fields in cave and karst research, as well as a significant facility used for education and outreach.

Ben Miller is an Environmental Research Specialist for the Hoffman Environmental Research Institute and Crawford Hydrology Laboratory. Ben currently leads the field and laboratory crew researching agricultural impacts and contaminant transport in karst areas in collaboration with the US Department of Agriculture. Ben has also support Hoffman research projects in the areas of cave survey, cave restoration, and development of cave management plans and has worked internationally on projects in Haiti, Puerto Rico, and Belize. Ben is a prolific cave surveyor and documenter, actively working with both state and national caving organizations. Prior to working for Western Kentucky University, Ben specialized in cave resource management, karst education, and karst hydrology while working for the National Park Service at Jewel Cave National Monument and Lava Beds National Monument as well as for five years at Missouri's Onondaga Cave State Park.

Management Guidelines for Caves and Karst in Parks Canada's Heritage Areas

Presented by Greg Horne, Resource Management & Visitor Safety Specialist
Jasper National Park, Box 10, Jasper, Alberta, T0E 1E0, Canada

Written by John Waithaka, Conservation Biologist
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Guidelines have been drafted to apply to cave and karst areas and their associated resources in all Heritage Areas managed by Parks Canada, the agency managing federal protected areas including national parks. The purpose of the guidelines is to ensure effective protection and management of caves and karst areas, including their natural and cultural resources and values.

A balance of use for the purposes of conservation, research, public education, visitor use and other activities related to cave and karst areas are delineated in a manner consistent with Parks Canada policies, legislation and corporate priorities. Basic management requirements for managers of Heritage Areas are outlined**.** The importance of a resource inventory is stated and potential documentation criteria listed.

A three tier cave classification for management and access purposes is defined and ranges from restricted to full access for the public. A selection of activities for cave and karst areas is presented that includes; research/collection, recreation, commercial, restoration and public education.

The importance of staff training and annual reporting related to the areas of caves and karst acknowledged.

This is the first time a national in scope series of guidelines has been drafted for the Parks Canada Agency. Although limited in detail, the guidelines provide more direction than was ever previously available for resource managers.

Greg Horne's 32 year career with Parks Canada began as interpretive planner then primarily was a Park Warden and more recently evolved to a Resource Management and Visitor Safety Specialist. Currently his core job duties relate to backcountry ecological monitoring. Duties related to cave management commenced in 1995 and the primary focus has been Jasper National Park and along with Castleguard Cave in Banff National Park. He has presented papers at three previous NCKMS events.

His passionate ongoing cave project is the exploration, inventory and mapping of a cave in Jasper National Park called the Ice Trap over the past 8 years.

Lincoln National Forest Revises a Cave Management Program

Jason Walz
Lincoln National Forest, US Forest Service

Lincoln National Forest is revising its Cave Management Program. The program complies with the WNS Interagency Response Plan for NM and follows the decontamination requirements of the FWS. It provides for smart recreational use while encouraging research projects and monitoring progress. Through its staff, and a large group of volunteers, Lincoln National Forest monitors bat use, bat population trends, visitor impacts and issues permits for all cave trips. In the future, Lincoln National Forest hopes to continue to provide recreational access while fulfilling its obligation to maintain its karst watershed and habitat.

Jason Walz accepted his current position, Cave Specialist, with Lincoln National Forest in June of this year after working for the NPS for 12 years. During his NPS years, he spent 9 years working in cave management at Wind Cave National Park and one year at Carlsbad Caverns National Park.

Diverse Cave and Karst Resource Management on the Tongass National Forest

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The Tongass National Forest is the largest forest in the National Forest System in the United States, encompassing over 6.9 million hectares covering the islands of the Alexander Archipelago and the narrow band of mainland from Dixon Entrance to Icy Bay. The Tongass contains 85 percent of the total karst in southeast Alaska, approximately 220,000 hectares primarily on Chicagof, Prince of Wales, and surrounding smaller islands. Cave and karst resource management focus is primarily on areas where timber harvest is permitted, however in Tongass geologic special areas alpine caves are managed for their unique resources including paleontology, archaeology, and biology. The Tongass conducted work in alpine caves over the past two years including installing monitoring equipment, inventorying new caves, and surveying leads in Snowhole and Blowing in the Wind on El Capitan Peak. Down at sea level, the Tongass began a monitoring program in karst springs on Kosciusko Island in conjunction with local landowners and the State of Alaska. Dye tracing was conducted along with ground surveys to delineate the study watershed. Monitoring probes were placed in two karst springs which were shown to drain from an area where the State of Alaska is currently planning to commercially thin young growth trees in 2013. The results from these and similar studies will guide management decisions on the Tongass.

Johanna Kovarik is a geologist and karst resource specialist on the Tongass National Forest in southeast Alaska, with a Master of Science from Western Kentucky University. Johanna is currently working on her PhD in Environmental Science and Policy from the University of South Florida, with a dissertation project involving cave and karst management in Chiapas, Mexico. Her research and management work focuses on protection of subsurface aquifers, particularlyin areas of karst development. In her spare time, Johanna is an avid caver, leading expeditions in southeast Alaska and participating globally in cave exploration and karst resource work with the US Forest Service, Hong Meigui Exploration Society, Cave Research Foundation, National Speleological Society, and others.

Cave and Karst Resources in West-Central Florida, USA: Implications For Management, Education, And Research

Jason S. Polk[1], Grant L. Harley[2], Leslie North[1], Philip Reeder[3]

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The active management of karst features, such as cave systems and springs, is virtually non-existent within the karst landscape of west-central Florida. Before sound management policies can be drafted, implemented, and enforced, stakeholders must first have knowledge of the distribution and importance of karst resources, and the human-environment interactions impacting them. Here, we present various methodologies combined in a concerted effort to collect, analyze, synthesize, and disseminate karst resource information using a geographical approach, including development and implementation of a cave resource inventory geodatabase, GIS mapping, cave survey, hydrologic inventory, and education and outreach activities about human-environmental interactions, focusing on an holistic approach toward cave and karst management and protection policies. We examined the karst landscape of west-central Florida on both public and private land, and analyzed these data to determine sensitive and vulnerable areas related to groundwater and cave resources. These activities culminated in three main goals, which include a cave and karst management plan for the Withlacoochee State Forest, creation of the Dames Caves Educational Preserve, and collaboration to develop karst groundwater publications with the Southwest Florida Water Management District in west-central Florida. This research is ongoing and will result in the creation of an informational avenue that will serve as a link between researchers, land managers, and the public to better understand and protect karst features in the study area.

Jason S. Polk, Ph.D. is the Associate Director of Science for the Hoffman Environmental Research Institute and an Assistant Professor of Geography and Geology at Western Kentucky University. He earned his doctorate degree from the University of South Florida in Geography and Environmental Science and Policy, where his research focused on karst speleogenesis, climate change, and water resources. Dr. Polk's current research investigates the geomorphology and hydrology (including water quality) of karst environments, isotope geochemistry, karst resource inventory and management, and the influence of climate change on paleohydrology. He has published over 30 peer-reviewed papers and abstracts, is a Fellow of the National Speleological Society, and is Vice President of The Karst Conservancy. He is also a member of the Geological Society of America, American Geophysical Union, International Association of Hydrogeologists, and Association of American Geographers.

Powell Mountain Karst Preserve: Strategies for the Permanent Protection of Omega Cave and Related Karst and Surface Resources

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The Cave Conservancy of the Virginias (CCV) owns and manages the 170-acre Powell Mountain Karst Preserve (PMKP) in Wise County, Virginia. In 2011, the CCV granted a perpetual conservation easement on the PMKP to the Virginia Outdoors Foundation to ensure its permanent protection. PMKP contains five known caves, including the Blowing Entrance to Omega Cave and the historic saltpetre sites in Parsons Cave and Franklin Pit. Recent exploration extended the surveyed length of Omega Cave to nearly thirty miles. With a depth of more than 1200 feet, Omega Cave is Virginia's longest cave and is the deepest cave in the USA east of the Rocky Mountains. The PMKP is part of a Mississippian scarp-slope karst system exhibiting a complex hydrogeology. Located within the Clinch Valley Bioreserve, the PMKP is part of one of the world's most important remaining biologically diverse intact ecosystems. The CCV's protection strategy for the PMKP places an emphasis on both significant cave and surface habitat and on multidiscipline science including exploration, cave mapping, and karst hydrological investigations using dye-tracing techniques. In 2008, the CCV contracted the Virginia Department of Conservation and Recreation Natural Heritage Program to conduct a biological inventory of vascular plants and plant communities and selected animal groups within the PMKP. Work included bat hibernacula surveys, mist netting, cave invertebrate sampling, general non-cave invertebrate sampling, a botanical survey, and natural community classification. Stewardship efforts include cooperation between cavers, the U.S. Forest Service, and various state agencies.

Joseph (Joey) Fagan earned his B.A. in Geography with a minor in Geology in 1976 from Emory and Henry College and studied Geography and Geology in graduate school at Virginia Tech during the early 1980's. Joey works as a karst hydrologist and environmental planning consultant for localities in cooperation with various state and federal agencies and NGOs. He was a Karst Protection Specialist for the Virginia DCR Natural Heritage Program from 2001 through 2009. Joey started caving in 1966; he is a member and Fellow of the National

Speleological Society (NSS). He is a founding member of Blue Ridge Grotto, a life member of the VPI Cave Club, and a member of the NSS Geology and Geography, Cave Conservation and Management, and Vertical Sections. He is NSS Youth Group Caving Coordinator for the Virginia Region. Joey serves on the Cave Conservancy Foundation and the Cave Conservancy of the Virginias Boards.

The Gating of Eagle Creek Bat Cave, Arizona

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Eagle Creek Bat Cave is large entranced cave located in a remote riparian canyon of Eastern Arizona. This single-roomed cave currently houses a summer colony of about 60,000 Mexican Free-tail bats. Historic roost estimates have quoted 30 million bats, but guano measurements put this number closer to 3 million. In 2001, vandals set a fire in the cave entrance that burned much of the historic guano mining workings and the guano pile. The following year bat exit counts numbered less than 10,000 bats. In 2010, MineGates, Inc fabricated and installed a huge 25 ft wide by 12 ft tall steel flyover gate to protect this unique site. Installation of this gate presented many unique challenges due to the size of the gate, and the remoteness of the location.

Tom Gilleland of MineGates Inc designed and installed scores of bat-friendly cave and mine gates for US Forestry, National Parks, BLM and private cave and mine owners. He is the founder and Co-owner of the Cathedral Cave Preserve (cathedralcave.org). Founder of the Arizona Cave Survey (arizonacaves.org). He has been an active caver for over 30 years, visited thousands of caves and mines in 20 US states and nine countries. He has extensive knowledge of caves and mines throughout the US, and especially the Western states of Arizona, New Mexico, Nevada, and California. He also has extensive experience working on cave and mine projects including archaeological, paleontological, biological, inventory and survey work.

The Geography of Karst

ames E. Kaufmann
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Effective management of karst resources and assessing the hazards and vulnerabilities of karst requires a thorough understanding of the geography of karst. Geography tries to answer such fundamental questions as "what is it, where is it, and how does it interact with its physical, biological, and cultural surroundings?" There is a wide variety of definitions for karst, but most karst scientists will agree that significant secondary porosity and hydraulic conductivity—especially vertical—are key components. Mapping and describing karst landscapes, however, are much more difficult tasks. Karst features are not always obvious and, as in the case of losing streams, not often depicted on maps. Advanced mapping methods, such as high resolution digital elevation models derived from lidar, can be used to locate and quantify features which fail to meet the normal minimum mapping standards for the U.S. Geological Survey's 1:24,000 scale topographic map series. Advanced analytical techniques use combinations of existing data sets to identify and classify regions of karst development but rely on data typically depicted on maps or gathered for more general purposes. Even with these advanced techniques, describing how karst interacts with its surrounding areas—especially the human environment—is a daunting challenge. Mapping the recharge area for a spring or group of springs requires intensive field work. Assessing catastrophic soil-cover collapse hazards often relies on interpolating or extrapolating data beyond their range of validity. With increasing development pressure on karst regions and greater demand for fresh water resources, a thorough understanding of the geography of karst is becoming increasingly important.

Jim Kaufmann is a research physical scientist with the U.S. Geological Survey's Earth Resources Observation and Science Center (EROS). Jim has many years of experience in cave and karst conservation and research and was co-chair of the 2007 NCKMS which was held in St. Louis, Missouri. Prior to working for the USGS he was the resident cave ecologist for the Missouri Department of Conservation and had spent several years prior to that building cave gates.

The Role of the National Cave and Karst Research Institute in Cave and Karst Management

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In the 2011 book *Karst Management*, I wrote a chapter that described six roles of national cave and karst institutes in cave and karst management. Here I describe the purpose, status, and goals of the National Cave and Karst Research Institute (NCKRI) relative to those roles:

- **Research.** NCKRI has an Applied Science Program but it has no staff. A basic program plan has been developed. Research is conducted opportunistically, currently focused on hydrogeological and geophysical studies, until dedicated staff are hired.
- **Education and Publication.** NCKRI's Strategic Education Plan is focused resource management. Rigorous implementation of the plan will begin once work on key education tools (website, museum exhibits, etc.) is completed in 2012. Three publications series are established.
- **Independent Advice and Arbitration.** NCKRI is a clearinghouse of information and insight. Technical advice is given through casual (e-mail, telephone, in-person) and formal (committee) means.
- **Data Archiving.** The Karst Information Portal is NCKRI's archive for all cave and karst data. The information if freely available at www.karstportal.org. Additional data resources are added daily, but more resource management tools await development.
- **Funding Generation and Granting.** NCKRI funding is currently focused on establishing the Institute, its facilities, staff, equipment, and programs. External support is very limited and will increase once NCKRI's core needs are met.
- **Collaboration Facilitation.** The needs of cave and karst management exceed the ability of any one person or organization. NCKRI actively builds and supports collaborations to maximize results with the limited resources available.

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 more than 20 years. He has conducted extensive 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 Union Internationale de Spéléologie (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 180 papers and five books, on hydrogeology, biology, and environmental management in karst.

Cave and Karst Resources Evaluation for Long-term Protection and Conservation

Dale L. Pate
Carlsbad Caverns National Park

This presentation will discuss the merits of and steps to take to evaluate complex cave and karst resources. This evaluation will include types of information needed by land management agencies or entities to better understand cave and karst resources within their jurisdiction including threats that may now be or have the potential for harming resources in the future. Knowledge of this will lead to better long-term protection and conservation of cave and karst resources.

Dale Pate is currently the Cave Specialist (Supervisory Physical Scientist) at Carlsbad Caverns National Park and also is the lead Cave and Karst Program Coordinator for the national-level Geologic Resources Division within the National Park Service.

Caves and Karst of the Providence Mountains Study Area, Mojave National Preserve: Building Upon Decades of Volunteer Contributions

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The Providence Mountains are located in the eastern Mojave Desert in San Bernardino County, California, and are one of the major carbonate ranges now located within the Mojave National Preserve, a 1.6 million acre unit established in 1994 by the California Desert Protection Act.

In 2010 a study area in the Providence Mountains was designated by the Mojave National Preserve in the award of a contract to locate and inventory caves and rock shelters and update information on all existing NPS caves within its limits. The study area encompasses a roughly 16 square mile area in the heart of Bonanza King Canyon – one of several major limestone canyons on the east side of the range, and an area with a rich speleological history that has received the attention of cavers since the 1960s.

The foundation of the MOJA cave database was established using early published reports, anecdotal information, and subsequent contributions from NSS cavers, the Cave Research Foundation, and park staff. This latest project brought together park personnel, contractors, and volunteers in a successful relationship that met project goals as well as preserved the history of earlier work.

The database was used to derive GIS maps and other digital mapping products to facilitate exploration, identification, and understanding of caves in the area. The final report includes the updated database with 133 caves and other features, new and updated maps, a biological inventory, a discussion of geology, and GIS maps and data products.

Bernard Szukalski has a degree in biology and chemistry, and has held a variety of positions during the last 25 years at Esri, the leading Geographic Information System (GIS) and digital mapping company where he is a senior staff member, product strategist, and evangelist. He is also Esri's cave and karst industry manager, and is a certified GIS professional (GISP).

Szukalski has been a member of the National Speleological Society and has been involved in organized caving since 1976. He has served on the board of directors of the National Speleological Society (NSS), Cave Research Foundation (CRF), Hawaii Speleological Survey (HSS), American Cave Conservation Association (ACCA), and Pennsylvania Cave Conservancy (PCC). He is a fellow of both the Cave Research Foundation and National Speleological Society. Szukalski currently serves on the Board of Directors of the Cave Research Foundation and holds the position of secretary.

Current Cave Management Projects at Jewel Cave National Monument, South Dakota

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Jewel Cave National Monument conducts a variety of research, management, restoration, and monitoring projects to aid in the understanding and protection of Jewel Cave. Recent efforts include: 1) evaluating an "air curtain" to reduce the amount of lint introduced via the Scenic Tour route, 2) developing photomonitoring techniques that employ digital image arithmetic to evaluate slight changes over time, and 3) use of digital image sampling to streamline the monitoring of dust along establish travel corridors within the cave. This paper presents status of these proof-of-concept investigations, in order to encourage further research to develop and implement these new techniques.

Mike Wiles was born in Huron, S.D. in 1956. Twenty years later, he was introduced to caving by members of the Paha Sapa Grotto, of the National Speleological Society, then a student grotto at South Dakota School of Mines and Technology. Since then, he has volunteered more than 7,000 hours toward the exploration of Jewel Cave.

He holds a B.S. in Chemical Engineering and an M.S. in Geological Engineering, both from SDSM&T. His 1992 Master's thesis is entitled, "Infiltration [of groundwater] at Wind and Jewel Caves, Black Hills, South Dakota.

Mike has worked at Jewel Cave National Monument for over 30 years, first as Interpretive park ranger, then as a Cave Specialist, and is currently the Chief of Resource Management for the park.

The Relationship of Recent Geologic Features to the Origin of Jewel Cave, South Dakota

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Over the last 20 years, exploration of Jewel Cave and geological mapping of the surrounding area have documented several unexpected relationships between cave features and surface geology.

The most striking observation is the fact that Jewel Cave exists almost exclusively in limestone capped with the Minnelusa Formation. This relationship holds throughout the southern Black Hills and, without exception, no cave over 500 feet in length is known to exist within uncapped limestone.

Furthermore, there is no mappable paleotopographical relief within the Jewel Cave Quadrangle. Rather, evidence within Jewel Cave strongly suggested that "paleofill" deposits developed contemporaneously with the development of the cave – after lithification of the basal Minnelusa sandstone.

Finally, ellipsoidal clasts have been mapped across 75 square miles north of the Jewel Cave fault. They were deposited contemporaneously with the development of the present-day topography; however, they also occur at two locations within Jewel Cave. Both are in close relationship with basal Minnelusa material, and one is sandwiched between the Minnelusa material and the cave's ubiquitous calcite crystal coating – yet they are beneath over 200 feet of non-cave-bearing rock, with no likelihood of nearby paleo-entrances.

These observations indicate a strong correlation between the passages of Jewel Cave and modern geological features. The evidence suggests that Jewel Cave formed as a result of the most recent processes that shaped the present-day stratigraphy, structure, and topography. There is virtually no evidence of a Mississippian paleokarst development. This gives pause for reevaluation of the origin of caves in the southern Black Hills.

Mike Wiles was born in Huron, S.D. in 1956. Twenty years later, he was introduced to caving by members of the Paha Sapa Grotto, of the National Speleological Society, then a student grotto at South Dakota School of Mines and Technology. Since then, he has volunteered more than 7,000 hours toward the exploration of Jewel Cave.

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Mike has worked at Jewel Cave National Monument for over 30 years, first as Interpretive park ranger, then as a Cave Specialist, and is currently the Chief of Resource Management for the park.

Update on the Development of the NPS Vital Signs Monitoring Protocol for Cave Visitor Impact

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Cave photomonitoring projects have shown that in low-energy cave environments, gradual change is almost imperceptible to humans; thus long-term monitoring methods have been developed. These changes, which have cumulative impact, are caused by cave visitation. Although, monitoring cave visitor impact has been a priority of the cave management community for a long time, these efforts were only developed for single caves or parks. No attempt was made to develop national vital signs until the Mammoth Cave Ecosystem Workshop of 2003. At that workshop, NPS cave management specialists identified major threats to cave and karst resources and the vital signs that should be monitored. However, cave visitor impact was not one of the six vital signs identified. The second attempt to develop national protocols was initiated at the NPS Cave Vital Signs Workshop held in Lakewood, Colorado in 2008. This workshop revisited the Mammoth Cave list and identified the vital signs that were common to all caves. Cave visitor impact was added as a vital sign protocol that would be developed and a committee was organized to accomplish that task. This group decided that the protocol would address four parameters of human impact on caves, which include: cave visitation, visitor touching, speleothem breakage, and cave visitor traffic. This presentation will present a status update on the development of this protocol.

Lehman Cave Restoration Project

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The Lehman Cave Restoration Project, funded through the Southern Nevada Public Lands Management Act, has restored 4,700 square feet of cave floor in Lehman Cave to a natural condition by removing over 800 feet of trails and 1,500 feet of electrical lines from the cave. These areas of the cave were closed to public use in 1981 following safety concerns in the Talus Room section. The project was carried out by park staff and volunteers from the Southern Nevada Grotto, a caving group of the National Speleological Society based in Las Vegas, as well as other cavers and grottos from Nevada and Utah. Volunteers removed trail, hauled buckets, and conducted an extensive before and after photo inventory. The concrete, asphalt, and sand making up the trail were removed one 5-gallon bucket at a time. Each bucket weighs over 52 pounds and staff and volunteers have hauled over 2,200 buckets totaling over 57 tons of debris. While most of the work is out of sight of visitors, dramatic changes in the Sunken Gardens area, part of the 90-minute tour, are visible. Presentation will focus on the project planning, implementation, documentation, and lessons learned.

Ben Roberts is currently the Chief of Natural Resource Management at Great Basin National Park. He has been involved in numerous park cave projects over the past 10 years.

SPANISH MOSS CAVE – 34 Year Photo Comparison Project

Michael Leavitt & Adam Leavitt

In 1976, 78 photos featuring cave formations in Utah's popular Spanish Moss Cave were taken and then given to the Timpanogos Grotto. In 2010, they re-surfaced and with the help of his father, Adam Leavitt created and managed his Eagle Scout project designed to recreate the 78 photos in to compare differences within the cave. The result is an online specialty website featuring the project, photos and findings. Spanish Moss Cave sits on Forest Service land and has been gated and its access managed by the local grotto since the late 1970's. This project has helped in determining the effectiveness of the management plan.

Adam Leavitt first started caving at age 6 in Utah's popular Nutty Putty Cave. It is ironic that he was one of the final cavers entering the cave as part of the caving death rescue/recovery team before its closure. Now at age 17, Adam has developed skills in vertical caving and has led several trips through local caves. As a Boy Scout since age 11, Adam was excited to take on the Spanish Moss photo logging project in his final step to attaining his Eagle Scout Award. Adam is very athletic and also a talented singer and stage performer. Only the passing of time will reveal where Adam's future college and life experiences will lead. One thing is for certain and that is Adam will have a fun-loving life full of music, stage, and outdoor experiences.

Michael Leavitt has been a caver since 1992 and the most recent Cave Access Manager of the now permanently closed Utah Nutty Putty Cave due to the well-publicized November 2009 death in the same cave. In his professional life, Michael is a long time home inspector and national speaker, author, and spokesperson on Home Inspection industry issues. Michael is also a skilled website designer and maintains over 50 business, personal, and non-profit websites. Michael is married to his lovely wife, Shelly, and enjoys being a father to his 4 great kids (3 of which also love caving), while doing his best adapting to the new role of Grandpa to twins. At 6'6" and 220 pounds, Michael is the last person you would expect to cram himself through incredibly tight passages, but he loves the subterranean adventure.

NUTTY PUTTY CAVE – Manual Cave Management Nightmare or Automated Website Tranquility

Michael Leavitt

When taking on the task of managing a highly visited and gated wild cave owned by a Utah State agency, you have monumental challenges and hurdles to overcome. These obstacles include the creation of:

1) Memorandum of Understanding.
2) Waivers and releases.
3) Access and caving rules.
4) Rules for qualifying Trip Leaders.
5) Method to distribute locked gated access for up to 6 caving groups a day, 7 days a week.
6) Method of acquiring trip reports for each caving group.
7) Creation of regular Cave Management Team inspection procedures and reporting.

In short, these are the perfect ingredients for either a manually managed nightmare, or a well-tuned automated website. This presentation deals with how and why I created and implemented the latter. We will visit the www.NuttyPuttyCave.com and discuss the features and information needed for the complete website caving reservation experience.

Michael Leavitt has been a caver since 1992 and the most recent Cave Access Manager of the now permanently closed Utah Nutty Putty Cave due to the well-publicized November 2009 death in the same cave. In his professional life, Michael is a long time home inspector and national speaker, author, and spokesperson on Home Inspection industry issues. Michael is also a skilled website designer and maintains over 50 business, personal, and non-profit websites. Michael is married to his lovely wife, Shelly, and enjoys being a father to his 4 great kids (3 of which also love caving), while doing his best adapting to the new role of Grandpa to twins. At 6’6” and 220 pounds, Michael is the last person you would expect to cram himself through incredibly tight passages, but he loves the subterranean adventure.

Studying Cave Visitation Trends

Jon Jasper
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Visitation data is vital information that can drive management changes for properly managing the use of caves. This presentation will show how visitation information has been collected, organized, and analyzed for the tours at Timpanogos Cave National Monument, uncontrolled visitation problems of the nearby Nutty Putty Cave, and pre and post gating of Bloomington Cave. Presentation will discuss the different techniques and benefits of gathering cave visitation data from tour tallies, cave registers, light sensors, and IR sensors.

Jon Jasper is an Outdoor Recreation Planner for the BLM Arizona Strip Field Office stationed in St George, Utah. Previously Jon has worked as a Cave Specialist for BLM Carlsbad Field Office, Timpanogos Cave National Monument, and Great Basin National Park.

Alpine Karst in Utah – An Overview

Lawrence E. Spangler
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Karst areas in northern Utah are located primarily in the Uinta Mountains and Bear River Range, and in localized areas within the Wasatch Range. Karst aquifers in the Uinta Mountains are developed primarily within Mississippian-age limestones along the flank of the anticline. In the southeast part of the range, surface water originating on the Precambrian-age sandstone core of the uplift sinks along the contact margin of the limestone and moves down dip to large springs that discharge from the Weber Sandstone. On the northern flank of the range, lateral movement of groundwater along bedrock strike also occurs.

Karst aquifers in the Bear River Range are developed within Cambrian to Silurian-age limestones and dolomites. Groundwater that largely originates from snowmelt runoff discharges from karst springs along the Logan River, the principal base level stream in the range. The Logan Peak syncline, a major regional structure that is bisected by the river, influences groundwater movement and cave development. In some areas, groundwater movement within Ordovician-age limestone is separated by an intervening quartzite from flow systems developed in Silurian-age dolomite. On the basis of dye-tracer studies, maximum groundwater travel times from recharge areas more than 1,150 m higher than and 12 km from the springs, typically are less than 3 weeks.

Karst and vulcanokarstic flow systems also are present in Tertiary-age limestones and basaltic volcanic rocks in the southwestern part of the state on the Markagunt Plateau. Dissolution of the Claron Formation and subsequent collapse of the overlying basalt have resulted in sinkholes as much as 300 m across and 30 m deep. Groundwater discharge from the plateau is largely from Mammoth Spring, which can exceed 300 cfs.

Larry Spangler has been employed as a groundwater hydrologist with the U.S. Geological Survey in Salt Lake City since 1988. He received an M.S. degree in geology from the University of Kentucky in 1982, with thesis work on the karst hydrology of the Inner Bluegrass Region in central Kentucky. After graduate school, Larry worked for a geological consulting company in Denver, Colorado, as a carbonate petrologist. Shortly after moving to Utah, he began karst hydrology studies in the Bear River Range in northern Utah to delineate groundwater flow systems using dye-tracing methods and has continued these studies to the present time. Larry has also conducted hydrologic studies of an alpine karst system on the Markagunt Plateau in southwestern Utah. Larry joined the NSS in 1974, has been Chair of the Wasatch and Salt Lake Grottos, and is an instructor in karst hydrology/geomorphology in the Speleology for Cavers short course at NSS Conventions.

White-Nose Syndrome:
The State of Knowledge and Management in 2011

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New York State Department of Environmental Conservation
Wildlife Pathology Unit, Delmar, NY

White-nose syndrome (WNS) has caused unprecedented mortality in hibernating bats in eastern North America. This previously unknown disease has spread rapidly since its discovery in New York in 2007, and poses a threat to hibernating bats throughout the continent. In 2010, DNA indicative of the fungus *Geomyces destructans,* the presumptive cause of WNS, was detected on bats as far west as Missouri and Oklahoma. The disease, WNS, and/or the fungus, *G. destructans*, has now been detected on bats at over 190 hibernacula in 19 states and 4 provinces. An assessment of wintering populations at 42 hibernacula across 5 northeastern states revealed a total loss of 88% of all bats in sites that have been affected for more than 2 years, with colony losses at some sites exceeding 99%. While our understanding of this disease has improved considerably, there are many questions that remain to be answered. The nature of remnant bat populations in the affected area has not yet been determined, and the potential for resistance within affected species has not been demonstrated. We also do not know the actual distribution of *G. destructans* on the landscape and lack the tools to manage the fungus once it becomes established. A coordinated effort is required to manage WNS and conserve North American bats, and there are over 100 state and federal agencies, tribes, universities, institutions, organizations, and private entities involved with the organized response. The *National Plan for*

Assisting States, Federal Agencies and Tribes in Managing White-Nose Syndrome in Bats, finalized in May 2011, provides the framework for a coordinated national response.

Jeremy Coleman is the Northeast Regional Wildlife Disease Coordinator for the US Fish and Wildlife Service, and is the National Coordinator for White-Nose Syndrome. He holds a MS and PhD in wildlife ecology from Cornell University and has been working on white-nose syndrome since starting with USFWS New York Field Office in February 2008. Jeremy is currently located at the USFWS Northeast Regional Office in Hadley, MA.

White-Nose Syndrome and the Ivory Billed Woodpecker

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A few years ago there was a flurry of publicity from the U.S. Fish and Wildlife Service about the discovery of a living Ivory Billed Woodpecker in eastern Arkansas. This species had long been considered extinct. The reported discovery made national news and shifted substantial funds from efforts to protect various species on the brink of extinction into activities in Arkansas. Not heard anything recently about the Ivory Billed Woodpecker being alive in Arkansas? Oops, inadequate science and over-zealous agency management rushing to promote their mission and enhance budgets. Carl Sagan reportedly wrote that "extraordinary claims should be backed by extraordinary evidence".

With the woodpecker episode in mind, reviewing the scientific credibility of agency responses relative to White-Nose Syndrome (WNS) is appropriate since some rather extraordinary claims have been made. Four specific agency positions are considered; they are:

1. That closure of caves on public lands will reduce or prevent the spread of WNS.
2. That WNS is spread, or is likely to be spread, by cavers or cave visitors.
3. That the only bat habitats that warrant management for WNS are caves and underground mines.
4. That it is appropriate to manage most or all caves on public lands as bat habitats to the exclusion of the many other uses and resources that caves provide.

Tom Aley holds B.S. and M.S. degrees from the University of California (Berkeley) and is President of the Ozark Underground Laboratory. He has published extensively on cave and karst management topics, and has been a frequent presenter at national cave and karst management symposiums. He has worked extensively on management issues involving federally listed threatened and endangered species. He and his wife own Tumbling Creek Cave, a National Natural Landmark that has the most diverse cave fauna of any cave west of the Mississippi River. Much of the food input for the Tumbling Creek Cave ecosystem is gray bat guano from a large summer population.

The U.S. National Park Service Response to White Nose Syndrome in Bats

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Thousands of caves and mines are administered by the U.S. National Park Service (NPS). Since 2008 the National Park Service has been preparing for the spread and effects of WNS through a proactive national program of response coordination, research support and interpretation, and education. Bats positive for WNS or *Geomyces destructans* have been detected at four sites in the National Park System, and have been detected within 100 miles of numerous units.

This presentation will provide information on how NPS units across the nation are uniquely situated to help educate the public, understand WNS and its ecosystem impacts, and assist in the conservation and recovery of affected bat species and cave ecosystems. This presentation will also provide insight into how the NPS manages its "dual mission" to provide both resource protection and visitor enjoyment, in the face of WNS, with specific examples of cave access management from several NPS units.

Kevin Castle is a veterinarian with the Wildlife Health Branch of the NPS Biological Resource Management Division, headquartered in Ft. Collins, CO. As one of four wildlife veterinarians in the NPS, Kevin works with parks and regions nationwide to preserve and improve the health of wildlife populations, by providing professional and technical assistance regarding animal health and welfare issues, zoonotic diseases, disease outbreak investigations, and training for park staff. Kevin has been with the NPS since March 2008, and has been working on white-nose syndrome since day one. Kevin is the NPS technical lead for white-nose syndrome, and has participated in Congressional briefings, National Plan development, and NPS white-nose syndrome working group coordination.

Implementing an Effective White-Nose Syndrome (WNS) Screening Strategy at Lava Beds National Monument

Shane Fryer and Shawn Thomas
Lava Beds National Monument

Lava Beds is home to 14 species of bats and protects some of the most significant bat populations in all of California. Lava Beds also has the highest known density of lava tube caves in the continental United States with over 750 caves scattered across the 46,000 acres. Of these caves, 24 have developments consisting of trails and bridges. Approximately 70% of Lava Beds 135,000 annual visitors enter at least one cave. Lava Beds has prepared a WNS response plan for the 2011 visitor use season. That plan utilizes the following strategies: 1) Education and Outreach, 2) Visitor Screening and 3) Targeted Closures/Adaptive Management. The plan has the following goals: 1) Reduce the chances of human-assisted spread of WNS to local bat populations, 2) Allow populations of bats to benefit from undisturbed reproduction and hibernation in preparation for the anticipated arrival of White-nose syndrome, 3)Allow for continued use in selected caves where screening mitigates the risk of human-assisted spread of WNS, 4) Increase public awareness of WNS and its potential impacts. In 2011, over 1,000 Townsends Big-eared bats were counted within winter hibernacula sites. The monument believes the WNS response plan will accomplish the above objectives and protect sensitive bats.

Shane Fryer is currently the Physical Scientist at Lava Beds National Monument. He has worked with cave resources within the National Park Service for over a decade, spending five years at Sequoia and now his sixth year at Lava Beds National Monument. As a component of his undergrad work at Western Kentucky University he spent 3 years interning/volunteering with 5 cave parks including Jewel Cave, Wind Cave, and Mammoth Cave. Shane has now participated in 14 international cave expeditions including Guatemala, Cuba, Indonesia and China. While, in the states he is still active in caving project back in Kentucky and in the Western US.

The Utah Bat Conservation Cooperative
A Statewide Framework for Bat Management

Kimberly Hersey and UBCC members

The Utah Bat Conservation Cooperative (UBCC) is an organization with the goal of conserving bat populations, communities, and habitats in the state of Utah through the joint efforts of various federal, state, university and private agencies with a stake in bat management. The partnership emphasizes science-based proactive management and provides input to natural resource planning, project development, and implementation efforts addressing bat related issues. Other objectives of the UBCC are to promote bat education to the public, provide training opportunities for UBCC members, and develop and prioritize bat research needs. Successes include consolidating all known historic Utah bat data into a web-based database, developing and implementing a standardized survey protocol, and providing bat capture and handling training. Current challenges include identifying important cave and mine habitats and developing prevention and response plans for the threat of white-nose syndrome.

Kimberly Hersey is a sensitive species biologist with the Utah Division of Wildlife Resources specializing in non-game birds and mammals. She currently serves as chair of the UBCC. She received her undergraduate training at Wittenberg University and her master's degree in wildlife biology from The University of Tennessee.

Bats at the Boy Scout Jamboree
An Outreach Event for Bat Education

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"What does a Bat Biologist do?" "What is bat guano used for?" "What is White Nose Syndrome?" These were just some of the questions Scouts discovered the answers to at the Boy Scout Jamboree. Scout troops around the country had been asked to stop visiting caves because of WNS management strategies. We decided telling the Scouts and their leaders about bats and WNS would answer some of their questions as to why the caving trips had stopped.

The 2010 Boy Scout Jamboree, at Fort A.P. Hill near Fredericksburg, Virginia, marked the 100th anniversary of the Boy Scouts of America. The national event was attended by 45,000 Scouts from across the United States. The Virginia Department of Conservation and Recreation (DCR) sponsored an exhibit area at the Jamboree on Bats and White Nose Syndrome (WNS). Project Underground, Bat Conservation International (BCI) and the Virginia Tech Science Outreach Program where partners in this project.

The exhibit contained three stations, each one with a different bat subject. Each station had an educational display with pictures and problems or activities for the Scouts to solve. The Scouts asked great questions and were very interested in WNS and the problems the syndrome caused the bats. They seemed to understand the importance of bats to the environment and the need to protect the bat habitats. 13,000 Scouts visited the Bat exhibit during the nine days of the Jamboree. The Scouts increased their knowledge about bats and came away with a more positive attitude towards them.

Carol Zokaites started caving in 1973 while attending Virginia Tech. She has participated in many cave mapping and karst conservation projects. Zokaites has helped create several karst publications including "Living on Karst," and the Project Underground Activity Guide and has authored many papers on cave and karst education. She is now the National Coordinator of the karst education program - Project Underground and the Environmental Education Manager for the Virginia Department of Conservation and Recreation. Carol Zokaites has a B.S. in Forestry and Masters of Arts in Education from Virginia Tech. She is a fellow of the National Speleological Society and has the received the National Speleological Society's Conservation award.

Building a Diversified Monitoring Program for Cave-dwelling Bat Species

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Bat monitoring has long been an important component of cave management, and understanding bat activity and use of caves by bats through monitoring efforts has in many cases informed bat protection efforts such as seasonal cave closures, as well as bat education and conservation measures. A number of bat monitoring methods have been used through the years, some quite successfully, while in recent years, new technology has begun expanding the range of potential in bat monitoring. Long-term bat monitoring programs have traditionally been difficult to implement, but new methods are emerging that improve data quality and collection while also easing the time input required. Acoustic monitoring shows promise as a reliable means of collecting long-term data on bat activity and occurrence, data which has become even more relevant with the current threat of white-nose syndrome (WNS). Acoustic monitoring itself encompasses a broad range of equipment and methods; it ranges from recording bat calls and attempting species identification to logging the activity levels of bat colonies based on the magnitude of bat calls. These acoustic monitoring methods can be used as the base of a rigorous bat monitoring program or can be used to supplement existing bat monitoring efforts such as in-cave searches, hibernacula surveys, and outflight counts. This paper examines some of the current leading bat monitoring methods, based on experience with these methods at Lava Beds National Monument, and makes recommendations for implementing long-term bat monitoring programs.

Shawn Thomas works as a Physical Science Technician at Lava Beds National Monument in northern California, where he has been stationed since 2009. He is part of the cave management program at Lava Beds and supports a variety of projects in the Resource Management Division. Shawn's primary focus is on bat monitoring and bat management, and he serves as the monument's representative in collaborating with agencies and researchers on white-nose syndrome and bat research. Shawn has been employed with the National Park Service (NPS) since 2005, and prior to arriving at Lava Beds, he worked at four other NPS cave parks. Shawn is also a caver and has been involved with cave exploration and other caving projects in the western U.S. for nearly a decade.

Bat Surveys, Bat Gates & Radiation-
Bats in Utah Abandoned Mines 1995-2010

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The Abandoned Mine Reclamation Program (AMRP) in Utah began in 1983. The program was closing abandoned mine openings without surveying for bats until 1995. From 1995 to the present day the AMRP has performed underground mine surveys for bats as a standard part of project development. Over this fifteen-year span the AMRP has collected bat survey data from over 40 projects addressing approximately 3,000 abandoned mine openings. Since 1995 the AMRP has installed bat compatible closures or excluded bats prior to closure as a standard part of closure construction. The AMRP has installed bat gates in abandoned uranium mines in the past, but this practice may be eliminated due to the concern with radiation exposure for bats.

This paper provides: (1) a statewide summary of the AMRP bat surveys (number of surveys, estimated cost, number of mine openings surveyed, mines with bats present or signs of bat use), (2) an overview of the bat compatible and non-bat compatible closure designs, estimated number statewide and costs, and (3) an overview of radiation exposure for bats in abandoned uranium mines.

Anthony A. Gallegos has worked in the AMRP eleven years as a Reclamation Engineer managing mine closure projects from the inventory and engineering phase through NEPA compliance to construction completion. My other duties include coordinating underground bat surveys and managing the radiation health and safety plan. Previously I worked in the Utah regulatory program for hardrock mining for ten years reviewing mining and reclamation plans, reclamation bonding, performing site inspections and coordinating mine permitting with other state and federal agencies.

My educational includes an MS, and BS in Mining Engineering from the University of Utah. I have been an instructor for the University of Utah teaching courses in their Natural Resource Learning program since 1990. When I am not working I enjoy whitewater boating, bicycling, triathlons, cross country skiing, diving and most any other outdoor fun.

How Resilient are Cave Ecosystems to Climate Change and Fire Suppression?

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Initial comparisons of recent organic carbon input into Oregon Caves with high resolution paleoclimate data from the last 330,000 years helped to define an extinction threshold for the Caves. Water samples from a wet (1992-1993) and a dry cycle (2010-2011) were analyzed for TOC (total organic carbon), conductivity (dissolved carbonates) and chloride from 7 subsurface sites and 2 surface points. Chloride is considered a cost effective proxy for evapo-transpiration while most of the TOC feeds bacteria that are the base of the food web. Conductivity appears to reflect surface photosynthesis or respiration changes. Increased roots from fire suppression and higher nightly temperatures may be accelerating the cave ecosystem's re-entry to a low carbon input comparable to the driest part of the Holocene. A further decline of organic carbon from this point may raise the normally low extinction rate typical of caves. The project will determine how wet and dry cycles affect cave ecosystems, and what mitigation measures are available to management should the region continue predicted trends toward prolonged droughts with extreme ENSO/PDO expressions.

Emily Ring is currently pursuing her Master's in Conservation Biology and is a Physical Science Technician with the Oregon Caves National Monument. Physical data collection for this project was supported by Southern Oregon University undergraduate Heather Bailey. Prior natural resource experiences for Ms. Ring include anadromous fish studies, wildlife inventory, riparian restoration and related hydrobiology work.

The Northern Karst Socio-Ecological Transect

Miriam Toro-Rosario[1], Waldemar Alcobas, Joel A. Mercado-Díaz, and Mariana Roca
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The Northern Karst Belt (NKB) is a physiographic zone of Puerto Rico which covers almost 33% of the Island's geographic area and extends about 160 kilometers from the municipalities of Loíza to Aguadilla. The diverse limestone formations in the area are characterized for its vast aquifers and underground cave systems that supply water to 25% of the population, 200 industries, and support 80% of the dairy production in the Island. The pressure these activities represent on the resources of this region increase with a recent proposal of the local government to extend the PR-22 highway. This project will threaten 46 kilometers within NKB of undeveloped lands, delicate community structures, and the ecological characteristics of the area. In recognition of these issues and inspired by the work of the ecologist Michael Fay, a group of four young Puerto Ricans organized an effort to walk the 46 kilometers segment of the proposed extension. The objectives were: (1) to document the potential impacts to economic activities and (2) gather information of the natural and social resources to be impacted by the PR-22 extension. The group also collected audiovisual material to document the existence of these resources, and the opinions of the communities to be affected. All the information generated from this effort will be used to produce a documentary film to inform citizens and policy makers about the implications of this project. Our goal is to educate the general public about the proposed road construction and prepare reference documents for stakeholders.

Miriam Toro-Rosario was born in Santurce, Puerto Rico and completed her K-12 studies in several schools in the metropolitan cities of San Juan and Trujillo Alto. In January 2011, Miriam graduated from the Environmental Science program at the University of Puerto Rico, Río Piedras Campus, and completed an undergraduate thesis dealing with the ecology of cave-dwelling insects in several caves systems in Puerto Rico. She is a current member of a number of local and international organizations like the Marine Environment Society, Puerto Rican Karst Speleological Research Foundation, The Conservation Trust of Puerto Rico, Ecological Society of America, Audubon Society, Organization for Tropical Studies, International Union of Speleology, Czech Speleological Society, and Critical Mass Dortmund in Germany. Miriam has recently enrolled in the Master's program of the department of Fisheries and Wildlife at the Michigan State University, specializing in Environmental Public Policy in tropical karst systems. Her main professional goal is to advocate and contribute to the public policy making of karst resources in Puerto Rico.

Biodiversity in High-Elevation Caves in Great Basin National Park

Gretchen M. Baker, Steven J. Taylor, Margaret A. Horner, Jean K. Krejca, Michael E. Slay, and Benjamin M. Roberts

In 2007, cave biologists and park staff conducted biological surveys in seven high elevation caves, all above 3000 m, in Great Basin National Park. Few cave biota were expected due to the cold temperatures of the caves, their distance from other caves, and limited nutrient inputs. However, these caves turned out to have abundant and diverse cave life, including several species endemic to the South Snake Range such as the pseudoscorpion *Microcreagris grandis*, the millipede *Idagona lehmanensis*, and the harvestman *Cyptobunus ungulatus ungulatus.* Additional cave biota found in some of these high elevation caves included springtails, cave crickets, flies, spiders, mites, and diplurans. These were also found at lower elevation caves in the park. Some species found in lower elevation caves, such as the millipede *Nevadesmus ophipmontis* and the globular springtail *Pygmarrhopalites shoshoneiensis* were absent from the high elevation caves. The facultatively trogloxenic butterfly, Milbert's Tortoiseshell *Aglais milberti*, was only recorded in two high elevation caves. Some high elevation caves had a number of unique taxa, largely due to accidentals found at their cave entrances. The elevation of the cave did not appear to have a significant correlation with the number of taxa nor the number of unique taxa. The biological complexity found in these high elevation caves alerted managers to the biodiversity found throughout the park's elevation range. The park plans to conduct additional monitoring of biota and climatic conditions to better understand these cave ecosystems.

Gretchen Baker is the park ecologist at Great Basin National Park. She has a new appreciation for high elevation caves and wet, muddy caves after noting how much biological diversity they support.

A Long-Term Strategy for Monitoring Biotic and Abiotic Parameters in Caves of the Klamath Region

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Zara Environmental LLC

Sean Mohren
Klamath Network-National Park Service

Daniel Sarr
Klamath Network-National Park Service

Shawn Thomas
Lava Beds National Monument, National Park Service

In 2005, the parks of the Klamath Network (KLMN) selected cave entrance communities and cave environments as two of their top 10 vital signs during phase II of their Inventory and Monitoring (I&M) Program. From 2008 to 2011, a team of cave scientists, researchers, statisticians, regional biologists, and monitoring specialists created a plan to measure eight parameters at 31 caves that would help track changes in cave environments due to visitation and associated uses. The four abiotic parameters the team chose were meteorology (temperature and humidity data loggers), water levels (staff gauges), ice volume (surveys from fixed points, photo stations), and human visitation (ticket sales, infrared counters, visitor logs). The four biotic parameters were vegetation (line transects), bats (winter counts), scat and organics (timed area searches), and invertebrates (bait stations). Field crews vetted the measurement techniques in a pilot study of over 20 caves at Lava Beds National Monument and Oregon Caves National Monument, and biologists tested for statistical power using two of the pilot datasets (climate and bats). Standard Operating Procedures detail each of these methods, and include quality control/quality assurance measures, training, data management, and reporting. The details of this project, which are documented in a monitoring protocol, are designed to make these data collection and syntheses efforts outlive changes in park staff and technology. This project met the goal of creating a financially supported monitoring protocol with anticipated results that will help direct management of park resources, public interpretation, and scientific research.

Dr. Jean Krejca has a Bachelor's degree in Zoology, and a Ph.D. in Evolution, Ecology and Behavior from the University of Texas at Austin. Her dissertation work focused on cave adapted aquatic fauna, biogeography and hydrology of Texas and North Mexico. Since 1991 she has worked as a cave biologist and her experience in that area spans across the United States (Arkansas, California, Texas, Nevada, Illinois, Missouri, Indiana, Tennessee, North and South Carolina) as well as Mexico, Belize, Thailand and Malaysia. In 2003 she co-founded Zara Environmental LLC where she continued her work from independent consulting and expanded to perform land management for landowners with endangered species, consult on endangered species permits, and perform custom research projects. In addition she has been involved with a variety of public outreach efforts such as public talks, field trips, and cave biology photography.

Ongoing conservation efforts to protect the Foushee cavesnail, *Amnicola cora* (Hydrobiidae)

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The Foushee cavesnail, *Amnicola cora* Hubricht 1979 (Gastropoda: Neotaenioglossa: Hydrobiidae), is a single-site endemic stygobiont found in Foushee Cave, Independence Co., Arkansas. Because little information was available concerning this species, a project was initiated in 2007 to establish baseline data on habitat use and population size. Sampling trips occurred during late spring and summer months to minimize disturbance to hibernating gray bats (*Myotis griscesens*) and at monthly intervals to minimize in-stream trampling of cavesnails. We established 25 sampling locations along the first ~1,000 m of cave stream and counted snails that occurred within a 0.05 m^2 quadrat placed haphazardly at each location. To characterize habitat use, we quantified snail position on substrate and measured water depth, flow, and substrate proportions. Sampling occurred during 3 visits in 2007 and 3 visits in 2011. The quadrat census project spurred additional conservation efforts by several Arkansas state agencies. The potential for groundwater impacts to the cave system was assessed with funding from Arkansas Game and Fish Commission, and this funding was used to delineate the recharge boundary, characterize vulnerability, and document point hazards. Following the recharge delineation, a landowner parcel assessment was conducted to determine number and size of parcels that overlay the cave system. This information was then used by Arkansas Natural Heritage Commission to identify landowners interested in selling property and several land acquisitions are now in progress. Following these acquisitions, over 80% of land recharging groundwater to Foushee Cave will be part of a new Arkansas state natural area.

Michael Slay has been working on karst conservation issues for ten years with much of his work occurring in the Ozark Highlands Ecoregion. Before joining The Nature Conservancy as the Ozark Karst Program Director, Mike coordinated karst research during positions held at University of Arkansas, Buffalo National River NPS, Illinois Natural History Survey, and Missouri Department of Conservation. Since joining The Nature Conservancy, Mike has worked with multiple partners such as US Fish and Wildlife Service, US Forest Service, Arkansas Game and Fish Commission, Missouri Department of Conservation, Oklahoma Biological Survey, and Illinois Natural History Survey to conserve and protect karst species and habitats. Mike has coordinated the exploration, species monitoring, and habitat analysis in several hundred caves and springs, and he has assisted with the discovery of over 15 karst species new to science. Mike received his undergraduate degree and M.S. in Biology at the University of Arkansas.

Population Monitoring of Illinois' State Endangered Enigmatic Cavesnail (Hydrobiidae)

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The Enigmatic Cavesnail, *Fontigens antroecetes* Hubricht (Gastropoda: Hydrobiidae) is known from only a single site in Illinois, Stemler Cave (St. Clair County). Other populations current identified as belonging to this species occur in Missouri. We initiated population monitoring in September 2009, and this monitoring continues through the present. We present findings thus far on snail densities and substrate preferences as determined by our sampling. We have also surveyed other sites in Missouri and Illinois to establish occupancy rates. No additional populations have been found in Illinois, and material from Missouri was confirmed at least to the generic level, with some material collected for comparative molecular analyses. The snail is threatened by declines in water quality, which likely are associated with changing land use practices accompanying urban sprawl in the greater St. Louis metropolitan area. The Enigmatic Cavesnail receives some protection in Illinois, both as a state-endangered species and because its range overlaps with that of the Illinois Cave Amphipod, federally listed as endangered. Within the drainage basin of Stemler Cave, the Illinois Department of Natural Resources, Illinois Nature Preserves Commission, and a variety of private groups, have been working to acquire natural areas upstream of the cave to help protect watershed integrity. Long-term protection of this species will require acquisition of better scientific data as well as vigilant and thoughtful land management.

Steve Taylor is a biospeleologist interested primarily in cave & karst biology, conservation and management. His research focuses on subterranean ecosystem structure and function, human impacts on subterranean ecosystems at a variety of scales from landscape level to site-specific impacts, considerations in cave and karst preserve design in relation to cave ecosystems, and subterranean biodiversity and knowledge gaps.

Bait Box Survey of Aquatic Invertebrates for Four Caves in Glacier National Park

Ernie Cottle
Sophomore at Flathead Valley Community College
and Bigfork High School Cave Club Alumni

To develop preliminary information on the natural history and population dynamics of aquatic cave invertebrates in Glacier National Park students of the Bigfork High School Cave Club conducted a non-collecting, bait box study in 4 caves. Small Tuperware containers with an entrance hole near the bottom were baited with liver and left in cave pools for 24 hour periods. Afterwards baited invertebrates were counted and returned to pools. Additionally, numbers of non-baited invertebrates were estimated, and water chemistry, pool size, and flow rate were measured each time bait boxes were set. In Poia Lake Cave both planarians (Polycelis?) and amphipods (Stygobromus glacialis) were baited. During the study, from the fall of 2009 to the spring of 2010, amphipod numbers remained nearly constant, but their distribution shifted closer to the entrance. Planarian numbers decreased. In Algal Cave planarians were baited and isopod (Samasellus stygonothryx) numbers were estimated. In this cave numbers of both planarians and isopods increased during spring runoff and decreased in late fall. No aquatic invertebrates were observed in the other two caves studied. Based on water chemistry and water flow at bait box sites, it is speculated that planarians are associate with water passing through soil directly over the cave and amphipods are associated with deeper flowing groundwater. Comparing data from this study to a similar one conducted in Algal Cave in 2000, planarian numbers have increased by a factor of 10, isopod numbers have decreased by a factor of 5, and amphipods have disappeared from the cave.

Ernie Cottle is an alumnus of the Bigfork High School Cave Club. While in the club, he has helped establish resource monitoring in several Glacier National Park caves, worked to develop a non-collecting scientific study of cave adapted invertebrates and cave water chemistry. When the club received ArcGIS, he helped enter the club's original cave data. He has given presentations to various groups ranging from Glacier Park Rangers to the 2010 ESRI International Users Conference. While he was co-president of the club, the club was awarded the President's Environmental Youth Award and traveled to Washington DC where he met members of the EPA as well as President Barack Obama. Since graduating the club he has remained an active caver and still does work with the Cave Club. He is in his sophomore year of college and is majoring in Underwater Archeology with a focus on Mediterranean cultures and minoring in ArcGIS.

Variation of $\delta^{18}O$ and $\delta^{2}H$ in the Carbonate Aquifers of the Cumberland Plateau in Southeast Kentucky

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In this abstract, we consider the variation of $\delta^{18}O$ and $\delta^{2}H$ (VSMOW) in samples collected during 2010 and 2011 at Stream and NBC Caves, one input to and the primary output from the Redmond Creek karst aquifer, respectively. We compare these data with $\delta^{18}O$ and $\delta^{2}H$ measured in concurrent precipitation samples from the same watershed. Collectively, these data lend insight into the source and timing of recharge to shallow groundwater along the Cumberland Plateau of southeast Kentucky—aquifers that remain an important supply of domestic water in this part of rural Appalachia.

The local meteoric water line (LMWL) of precipitation has a fit of $\delta^{2}H = (7)\ \delta^{18}O + 10.5‰$ ($R^2 = 0.96$). Values of $\delta^{18}O$ and $\delta^{2}H$ at Stream Cave (-7.25‰ ± 0.16‰ and -40.84‰ ± 1.24‰) and NBC Cave (-7.23‰ ± 0.19‰ and -42.40‰ ± 2.24‰) cluster at the midpoint of the precipitation data on the LMWL, are not statistically independent populations, and remain stable during the study despite changing temperature regimens and rates of discharge.

Applying a Priestly-Taylor PET model combining data from local weather stations, we find that only 43% of precipitation remains as potential recharge, primarily during cooler months with lower solar insolation. Values of $\delta^{18}O$ and $\delta^{2}H$ weighted by potential recharge (-7.38‰ ± 0.75‰ and -40.18‰ ± 4.02‰) are statistically similar to shallow groundwater with more variability and seasonal dependence. Specifically, there is a proportional relationship between precipitation d18O and d2H versus average temperature (R2 = 0.43 and 0.34).

Values of D_{ex} are greater than +10‰ for all samples, suggesting contributions from re-evaporated, continental moisture. Furthermore, precipitation D_{ex} is inversely proportional to average temperature ($R^2 = 0.43$) that reveals moisture sources during the winter months more influenced by evaporation. In shallow groundwater, there is a slight increase in average D_{ex} from Stream to NBC Caves (-16.9‰ to -17.4‰) suggesting additional evaporation along the flowpath.

Lee J. Florea is an Assistant Professor of Geology at Ball State University and a registered professional geologist in Kentucky and Indiana. Lee earned his PhD in Geology from the

University of South Florida where he produced a dissertation titled “The Karst of West-Central Florida” in 2006. Following his dissertation, he spent two years as a Mendenhall Postdoctoral Fellow for the US Geological Survey in Ft. Lauderdale where he began his investigations into stable isotopes. An avid cave cartographer, founding president of the Kentucky Speleological Survey, and a fellow of the National Speleological Society, Lee has explored and published studies on the caves and karst of Kentucky for more than fifteen years.

Seasonal Variation of Carbon Dioxide in Oregon Caves

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Analysis of ten years of atmospheric carbon dioxide data in Oregon Caves was performed to identify CO_2 sources, distribution, and variability. Preliminary analysis discovered significant seasonal variation, which correlated with results from a marble dissolution study. The highest CO_2 concentrations were found at stream level in the lower part of the cave. Peak CO_2 throughout the cave occurred in summer. Discussion will include potential interpretation of these results.

Elizabeth Hale is a GIS Specialist at Oregon Caves National Monument, where she has been working in resource management since 2005.

Groundwater Development May Harm National Park Caves

Gretchen Baker
Great Basin National Park

Great Basin National Park contains 42 caves, including several that contain ground water, surface water, or both. Caves that are connected to the water table are of special concern to park managers due to a proposed groundwater development project in the area. Southern Nevada Water Authority plans to pump substantial amounts of water from the two valleys adjacent to the national park. Although the park is over 1,500 feet higher than the valley floor, the USGS has conducted a study that shows park resources, including caves, could be impacted. Additional studies have shown the likelihood of interconnection between the valley-floor aquifer and the water under the caves. Changes in water levels under caves have the potential to alter cave-forming processes and impact the ecology of the caves. Several endemic species make park caves their home, so this is of great concern to park managers. The park has commenced biological, temperature, and water level inventory and monitoring to develop a baseline dataset of cave conditions. In addition, the park has worked to communicate the fragility of these cave ecosystems to those responsible for making decisions with regards to this project.

Gretchen Baker is an ecologist at Great Basin National Park, where she has worked the last ten years. She has been a caver for 17 years.

The Role Interpretation and Volunteers Play in Cave Resource Protection

Dawn Ryan

The mission of the National Park Service states in part, "..to preserve and protect and leave unimpaired …. for the enjoyment of future generations." National Parks serve two primary purposes; they preserve recognized significant features, while at the same time allowing for their enjoyment. And though it may seem contradictory that preservation and enjoyment are mutually incompatible, to believe such is to misunderstand our parks. For the modern history of our parks is the story of the relationship between both goals. As natural resources managers most of us are involved in the "preserve and protect" aspect of the goal. However, parks are not just zones of preservation and they are not merely areas set aside to be enjoyed. Successful park management lies in the combination of these two goals and this is where the role of the interpreter and volunteer come in to play.

Dawn Ryan's caving career started about 11 years ago when visiting a commercial cave in Wisconsin. In those 11 years of caving since, Dawn has led cave surveys and cave adapted invertebrate inventories. Over the years she has served as the membership committee chair for the National Speleological Society and has been awarded a fellow of the Society as well as the e Cave Research Foundation. Dawn is also a permanent interpretative ranger at Sequoia National Park working at that park for five years while working on completing a degree at Oregon State University in natural resources management.

Volunteer Recognition: What We Can Do for Them

Bonny Armstrong
Timpanogos Cave National Monument

Jim Goodbar
BLM Carlsbad Field Office

The importance of volunteer service to cave resources management programs has been long recognized and written about. Cavers donate vast amounts of man-hours worth hundreds of thousands in monetary value each year. Their volunteer service is highly specialized with specific types of work that would be considered as "scarce skills" in the government. This includes cave surveying and cartographic map production, resource inventories, specific scientific research such as microbial, mineralogic, and hydrologic studies, and assistance with writing cave specific search and rescue plans. All these are operations that many cave resource managers could not afford to hire done but are essential for the effective and responsible management of cave and karst systems.

What has been given only minimal attention is what the agencies can do to give recognition and rewards back to the volunteers. Most federal agencies have formal volunteer programs that provide for the recognition of the services that are given. This paper highlights some of the specific actions, recognitions, and awards that can be given to the volunteers that make the success of the cave resources management programs possible. Such things as letters of recognition, certificates of appreciation, volunteer banquets, national awards, media coverage, and reimbursement for expenses are but a few of the ways that agencies can show cave and karst program volunteers how much their service means to this heavily underfunded and vulnerable program.

Bonny Armstrong holds a Master's Degree in Geology from Western Michigan University and currently works as a physical science technician for the National Park Service at Timpanogos Cave National Monument. One of the duties of her position is organizing and working with volunteers on a number of cave-related projects. She herself is also involved with volunteer activities, mainly exploration and survey, at other national park units including Carlsbad Caverns National Park, Wind Cave National Park, and Jewel Cave National Monument. Bonny is a life member of the NSS and serves on the Membership Committee, the Review Committee for the American Caving Accidents publication, and assists locally and regionally with cave rescue training.

Techniques for Incorporating Karst and Cave Science in Cave Guide Training

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Cave guide training for commercial cave tours typically consists of familiarization with the cave route and associated infrastructure, tour protocol as established by the owners/mangers, basic tour group management, competence in use of basic cave equipment, safety and emergency protocols, and often times cave conservation. This ensures that the guides conduct a tour responsibly with respect to the visitor, and the cave. Most show caves have an interpretive facet to their tours. To that end the guide may be provided with an interpretative outline or script which outlines descriptive and sometimes scientific information about natural resources within and specific to the show cave. It is not uncommon for the guide to convey interpretative information to the visitor either recited rote, or presented as summarized from the script. These modes of interpretation for visitors do not provide a quality educational experience, do not instill an appreciation for caves in general, nor do they motivate visitors to protect caves and karst resources. What makes a cave tour an effective learning experience for visitors is how the guide presents their knowledge about the cave and karst in general. A general background in cave and karst science, and how the information relates to the specific show cave and are, gives the guides a better understanding of caves and karst that they can convey on their tours. The authors provide examples of science-based cave guide workshops that have been conducted in Barbados, Puerto Rico, and in China that have expanded the knowledge of the cave guides and provided them with interpretative resources to help them enhance their tours. Examples of training methods and effectiveness of the training will be reviewed.

Pat Kambesis is an experienced cave explorer and karst scientist who has work nationally and internationally on cave documentation projects, cave and karst research, and cave and karst management issues and concerns.

Comparison of Cave Gate Materials

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Many types of steel have been used over the years in building cave gates, including ¾" and 1" rebar, 1" Manganal© hardened steel bars, 3"x4" rectangular tubular bars, 2", 3", and 4" angle iron bars, and stainless steel tubular and angle iron bars. There are pros and cons to each. We will compare and discuss each material, focusing on cost, weight, availability, ease of use, and perhaps most importantly, strength and cross-sectional restriction of flight space. The 4" angle iron bars (with stiffeners) that have long been recommended by the American Cave Conservation Association and Bat Conservation international have clear advantages to the alternatives. Designs using these materials have become the default "industry standard" for bat gates, and are widely accepted by the U. S. Fish and Wildlife Service, the National Park Service, the U. S. Forest Service, the Bureau of Land Management, The Nature Conservancy, and other major cave management entities.

Combining Teenagers, Cave Monitoring, and ArcGIS

Brennen Shaw, Sandi Baker, and Katie LaFeaver
Bigfork High School, Northwest Montana
Sponsor: Hans Bodenhamer

Since 2005 the Bigfork High School Cave Club has conducted cave monitoring and conservation projects in scores of cave on federal lands. The club's work has greatly benefitted cooperating agencies and student members. In 2009 the club adopted use of ArcGIS. Students will highlight aspects of their projects in Glacier National Park and Grand Canyon National Park as a live demo in ArcGIS. Students will use the program to overview and compare resources from many caves in each park. They will use show how they use georeferenced cave maps as a base layer and how they organize and manage hundreds of pages of photomonitoring and Visitor Impact Point data they have collected. Students will also show how they use ArcGIS to show the extent and distribution of mineral, biologic, cultural, hydrologic, and climatic resources, how the program can be used to rate and compare individual features in terms of significance, fragility, and condition, and finally how the program can be directly linked to management using a LAC (limits of acceptable change) model.

The Bigfork High School Cave Club was created in 2005 to provide high school students with opportunities to participate in wholesome recreational activities through cave exploration and work with local land managing agencies such as the US Forest Service and National Park Service to restore and conserve fragile cave resources. The club maintains an active membership of 15 students. The cave clubbers participate in about 3 recreational trips each year and 3 conservation projects.

Brennen Shaw is a senior at BHS. He works as a mechanic at his father's auto repair and tire shop. As a member of the Cave Club, Brennen has worked as a volunteer in caves in Glacier National Park, Grand Canyon National Park, Flathead National Forest, Lincoln National Forest, and Lewis and Clark National Forest. Next year Brennen plans to attend college at Montana State University to study mechanical engineering.

Katie LaFeaver is a junior at BHS. She holds down two afterschool jobs, one as an assistant chef at a pizzeria and the other as a maintenance assistant and groundskeeper for a home community association. Katie has worked as a volunteer in caves in Glacier National Park and Flathead National Forest. After high school Katie wants to study to become a hospice nurse.

Sandi "Ninja" Baker is a junior ay BHS. She works after school as an assistant chef at a French restaurant. She is also a member of the school's soccer team. Sandi has worked as a volunteer in caves in Glacier National Park, Grand Canyon National Park, and the Flathead National Forest. After high school Sandi wants to return to her home state, Alaska, to attend college.

Building a Successful Trip Leader Training Program

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Proper management of public caves requires partnership with cavers. How can managers give cavers an active role in cave management while ensuring that agency goals and requirements are being met? One of the most effective ways of doing this is to build a trip leader program. This allows managers to manage a smaller amount of trip leaders, with them in turn managing other volunteer cavers. Trip leader programs provide a sense of ownership for volunteer cavers. When the system is built on mutual trust and respect, and volunteers are treated as extended staff, many mutual goals can be accomplished. Focusing on the trip leader training program enacted at Jewel Cave National Monument in 2006, the essential components of a successful trip leader program will be discussed and evaluated.

Andy Armstrong works in cave and karst management for the National Park Service and is currently the Resource Management Specialist at Timpanogos Cave National Monument. Previously he has worked in cave resource management and interpretation at Jewel Cave National Monument, and Carlsbad Caverns National Park. Primarily focusing on the exploration and survey projects at Jewel Cave and Lechuguilla Cave, he and his wife Bonny are active in cave exploration and conservation throughout the Intermountain West and beyond. Andy holds a Bachelor of Science degree from East Tennessee State University, and is an instructor for the National Cave Rescue Commission.

Cave Rescue Pre-Planning at Wind and Jewel Caves, South Dakota

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Wind Cave National Park and Jewel Cave National Monument have completed the first phase of a cave rescue pre-plan. The pre-plan concept is based on previous work at Lechuguilla Cave, New Mexico, and involves evaluation of specific obstacles along main travel routes in the caves to prepare for a rescue. Specific anchors, gear needs, extrication techniques, and any modification requirements are noted for each obstacle, and are documented with photographs and diagrams. Such pre-planning can save valuable time and resources during a rescue. The plans emphasize small party and minimal gear techniques, which are necessities in remote areas of Jewel and Wind Caves.

Rene Ohms is a physical science technician for the National Park Service at Jewel Cave National Monument, South Dakota. During her career with the NPS, she has been an interpreter, fire effects monitor, and, for the last 12 years, a resource manager specializing in cave management. She maintains the Jewel Cave rescue cache and coordinates cave rescue operations for the park, and is a National Cave Rescue Commission instructor. Rene has been a caver for 16 years and particularly enjoys project caving and survey. She holds a Bachelor of Science degree in Biology from the University of Arizona, and has continued graduate education in Geographic Information Systems.

Characterization of Cave-Inhabiting Arthropods of Puerto Rico: Potential Tools for Conservation

Poster only

Miriam Toro Rosario[1] & Elvira Meléndez Ackerman

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This research gathered baseline data on arthropod diversity, abundance, and environmental characteristics of four caves with varying human use. These caves located in North Karst Belt of Puerto Rico were surveyed in October 2009 (rainy season) and April 2010 (dry season) for soil arthropods. Within each cave visibility, temperature, and relative humidity were measured in three zones delimited by light quality (entrance, twilight, and dark). These zones were significantly different in their visibility estimates but not necessarily in terms of their temperature or relative humidity. Overall, within cave temperature showed a negative (but weak) correlation with relative humidity. Temperature was only positively correlated with arthropod diversity but the role of temperature on abundance could be discarded given that diversity and abundance were highly correlated. More species were captured at rainy season survey, but these tendencies were not consistent with temperature or relative humidity differences between censuses. Our pooled samples yielded 5,922 soil cave specimens that included 41 morphospecies distributed among 17 orders. Hemiptera (67%), Acari (48%), and Isopoda (6.6%) were the most dominant orders in all caves. The dominance of Hemiptera at these cave systems is a departure from what has been reported in well-studied caves elsewhere. Given the potential links between temperature and cave biota future studies should explore the use of cave biota as potential indicators of change in cave systems and in particular how these may respond to expected increases in climate in the Caribbean region.

Miriam Toro-Rosario was born in Santurce, Puerto Rico and completed her K-12 studies in several schools in the metropolitan cities of San Juan and Trujillo Alto. In January 2011, Miriam graduated from the Environmental Science program at the University of Puerto Rico, Río Piedras Campus, and completed an undergraduate thesis dealing with the ecology of cave-dwelling insects in several caves systems in Puerto Rico. She is a current member of a number of local and international organizations like the Marine Environment Society, Puerto Rican Karst Speleological Research Foundation, The Conservation Trust of Puerto Rico, Ecological Society of America, Audubon Society, Organization for Tropical Studies, International Union of Speleology, Czech Speleological Society, and Critical Mass Dortmund in Germany. Miriam has recently enrolled in the Master's program of the department of Fisheries and Wildlife at the Michigan State University, specializing in Environmental Public Policy in tropical karst systems. Her main professional goal is to advocate and contribute to the public policy making of karst resources in Puerto Rico.

Reconciling Speleothem Sampling for Paleoclimate Research with Cave Conservation

Poster only

Sarah Truebe[1], Michael Lee, Julia Cole, & Heidi Barnett
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In addition to being aesthetically appealing, cave stalagmites can provide high-resolution, absolutely-dated records of regional climatic change. However, sampling for climate records is inherently destructive; speleothem material is consumed for radiometric (uranium-series) dating and for isotopic analyses. Historically and into the present, many paleoclimate labs remove multiple stalagmites from caves, slab them, and process them, without any thought to cave conservation. However, other labs have been much more conscientious in their attempts to develop new methods, and many paleoclimate scientists in the international community are starting to recognize the need to make speleothem paleoclimate research more sustainable. We propose that with a combination of careful site selection sampling techniques and processing methods, creative new methods for speleothem replacement in the cave, and archiving of speleothem deposits, cave conservation and paleoclimate reconstruction can be reconciled. Here we use case studies from southern Arizona to demonstrate successful examples of site selection (including cave monitoring and modeling studies), sample selection (including observational data and preliminary sampling for identifying age-appropriate stalagmites), processing methods (including coring), and speleothem replacement strategies (including construction of "pseudo-mites"). We present these methods not necessarily as best practice, but rather to begin more serious discussions between cave managers, cavers, and paleoclimate researchers. As a community, we hope to develop best practice methods and employ them as soon as possible to avoid irrevocable damage to caves in the United States and worldwide.

Sarah Truebe grew up in Tucson, Arizona, where I learned to observe the world from my parents (a geologist/caver (NSS #5071) and an archaeologist). Growing up with saguaros, I also learned to love the Sonoran Desert and the North American monsoon. Pursuing these interests, I went to Stanford University to major in Earth Systems (interdisciplinary earth science and policy). I received a Master's in Earth Systems from Stanford as well. Then, I was a research assistant in a lab focused on the end-Permian mass extinction, where >90% of all marine life went extinct. This experience provided vital perspective on more recent environmental change, which I now study using cave speleothems from southern Arizona as a PhD student at the University of Arizona. When I'm not researching, I play piccolo with the Tucson Repertory Orchestra, volunteer with the Southern Arizona Rescue Association, and explore Tucson's fine mountains (above and below ground)!

Assessing Impacts to Endangered Karst Invertebrates in Central Texas

Poster only

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Sixteen species of karst invertebrates are listed as federally endangered species (including spiders, beetles, and pseudoscorpions) in Central Texas. Assessing impacts to these species is a particularly challenging endeavor considering their cryptic nature and low detection probabilities. The Service (U.S. Fish and Wildlife Service) is incorporating the limited life history information on these species into an assessment tool that will help determine likely impacts from project activities, for example, construction near or in cave and karst areas. It also provides suggestions and conservation measures to avoid or minimize those impacts. This tool is being developed by Service employees with knowledge on these species and will allow project proponents direct access to these data when a Service biologist may be unavailable. While this tool will provide useful information to project proponents, it can also help determine whether consultation with the Service should ensue. For example, if by using this tool it becomes apparent that activities from a project will harm or harass an endangered karst invertebrate, then the Service should be contacted. By providing this information in a readily available format, we believe that this tool will assist in preserving more karst areas and provide consistency in how impacts are being avoided, minimized, and mitigated.

Cyndee Watson earned her B.A. in Geography with a minor in Zoology from the University of Texas at Austin in 2002. That same year she entered Texas State University-San Marcos where she completed her Master's thesis on estimating the probability of detecting golden-cheeked warblers. While in graduate school, she started her career at the U.S. Fish and Wildlife Service as a wildlife biologist working to recover endangered karst invertebrates where she still is today.

Responding to the Threat of White-Nose Syndrome at Oregon Caves

Poster only

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Oregon Caves National Monument began screening visitors in 2011 to prevent the human-aided spread of the fungus associated with white-nose syndrome in bats. In the first three months of the 2011 tour season, the screening process effectively intercepted more than twenty instances of visitors wearing or carrying an item that had been used in a cave or mine within 500 miles of an affected site or in Europe, resulting in actions to exchange clothing or disinfect footwear or glasses. Additional measures were implemented to avoid white-nose syndrome, including screening employees when they enter on duty, modifying cave tour routes in spring and fall to avoid hibernating bats, permitting only dedicated caving gear in Oregon Caves, outfitting off-trail caving groups with coveralls, increasing bat surveillance, and developing outreach to build awareness of the disease.

Elizabeth Hale is a GIS Specialist at Oregon Caves National Monument, where she has been working in resource management since 2005.