Park News

Great Basin National Park
National Park Service
U.S. Department of the Interior

The Midden

The Resource Management Newsletter of Great Basin National Park

Hymenoptera Bioblitz Nets New Species to Park and Science

By Gretchen Baker, Ecologist

Photo by David Hunter

Entomologist Curtis Irwin from the Nevada Department of Agriculture sorts specimens brought in during the 2011 Bioblitz.

Over 80 people joined in the park's third annual Bioblitz August 1-3, 2011. This short term discover biodiversity event helped the park add to its list of Hymenoptera (wasps, bees, and ants). Dr. James Pitts from Utah State University led the effort, with assistance from his graduate students and entomologists from the Nevada Department of Agriculture, University of California-Davis, University of Nevada-Reno, and the Utah Natural History Museum. Volunteers came from California, Utah, Colorado, and Nevada.

The event began with a workshop about Hymenoptera featuring several speakers. It was followed by a lunch sponsored by the Western National Parks Association. Participants than embarked on a 48-hour collecting period.

Volunteers, ranging in age from 3 to more than 80, collected Hymenoptera by various methods. Some used nets to sweep vegetation, forceps to pick up ants, bowl traps with soapy water to attract bees, and light and malaise traps to catch a variety of species. Bioblitz participants filled out data sheets to indicate the location, habitat, and collecting method. Everything was brought back to Bioblitz headquarters, where data was entered into a computer and entomologists began sorting samples.

The Bioblitz also provided an excellent venue for sharing the importance of insects with park visitors, staff, and volunteers. The Bioblitz included numerous educational programs, including a workshop, kids' programs, a campfire talk, and patio talks about Hymenoptera. The science class from Woodlin High in Colorado participated. A photographer helped document the event and some of the insects.

The event ended with a lunch sponsored by the Great Basin National Park Foundation and raffle prizes from the Western National Parks Association. Dr. Pitts made closing remarks, noting that over 400 specimens were collected, with at least 25 families and 65 species of Hymenoptera. Dr. Pitts also remarked that he had seen several velvet ant species that he had not expected to be in the park. Following the Bioblitz, most of the specimens were taken

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to his lab to be sorted, pinned, and identified.

Back in the lab, the entomologists discovered that one of the species collected was a new species to science!

This new species is in the family Tiphiidae, the Tiphiid wasps. These wasps are relatively small (up to 30 mm) and solitary. They lay their larvae on beetles, so they are considered parasitoids. The genus is *Acanthetropis*, but the species name has yet to be determined. Stay tuned for the unveiling of this new creature!

The park thanks everyone who participated and helped with the Bioblitz. This has been a great way to learn more about the invertebrates that inhabit the park, as well as share information about the importance of these small creatures in our world.

The park is in the planning stages for the fourth annual Bioblitz, which will focus on Diptera, or flies. It will be held June 19-21, 2012. Contact Gretchen_Baker@nps.gov for more information.

Photo by David Hunter

This velvet ant is a wasp, *Dasymutilla vestita*, in the family Mutillidae.

Photo by David Hunter

Retired entomologist Ken Kingsley assists a student with identification.

Recent Publications about Great Basin National Park

Reinemann, S. A., N. A. Patrick, G. M. Baker, D. F. Porinchu, B. G. Mark. and J. E. Box. 2011. Climate change in Great Basin National Park: Lake sediment and sensor-based studies. ParkScience 28(2):78–82. Available online at http://www.nature.nps.gov/ParkScience/index.cfm?ArticleID=518

Shakun, J. D., S. J. Burns, P. U. Clark, H. Cheng, and R. L. Edwards. 2011. Milankovitch-paced Termination II in a Nevada speleothem? Geophysical Research Letters 38. L18701, doi:10.1029/2011GL048560

Vilkamaa, Pekka, Heikki Hippa, and Steven Taylor. 2011. The genus *Camptochaeta* in Nearctic caves, with the description of *C. prolix* sp. n. (Diptera, Sciaridae). ZooKeys 135:69-75. Available online at: http://www.pensoft.net/journals/zookeys/article/1624

How Old is Lehman Cave? *New data suggest: more than 1 million years*

by David McGee, Massachusetts Institute of Technology

How old is Lehman Cave?
This is one of the most common questions asked by park visitors, but it turns out to be difficult to answer directly. One way to place limits on the cave's age is by dating stalagmites and stalactites from within the cave – clearly, the cave has to be older than the oldest formation within it.

Geologists trying to date the cave's formations are helped by the fact that rainwater percolating through the soil and rock above the cave picks up small amounts of the radioactive element uranium. This uranium ends up in stalagmites, stalactites and flowstones when they form at a concentration of roughly one part per million – that is, for every gram of stalagmite, there's a millionth of a gram of uranium.

Because uranium is radioactive, it's constantly decaying. Uranium-238 has a long chain of intermediate daughter isotopes, each of which is itself radioactive, ending with a stable isotope of lead (Figure 1). Once uranium-238 is trapped within a cave formation, its decay causes these daughters to begin accumulating in the formation. Eventually each radioactive daughter comes into equilibrium with its ultimate parent uranium-238; that is, once there are enough atoms of the daughters, their decay rate is equal to the supply from farther up the decay chain.

In several Lehman Cave stalagmites, the daughter isotopes uranium-234 and thorium-230 are in equilibrium with their parent uranium-238.

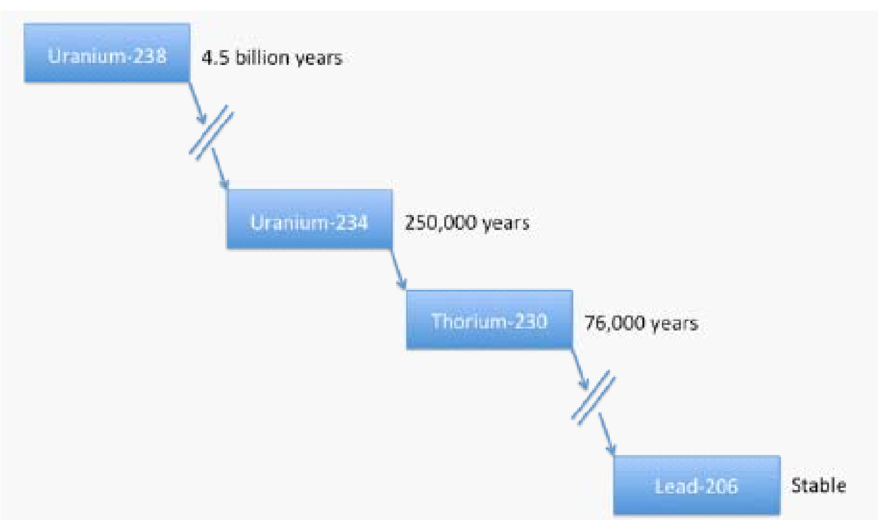

Figure 1. A simplified version of the uranium-238 decay chain. The number next to each isotope indicates its half-life – that is, the time after which half of a given number of initial atoms will remain. The double lines indicate that intermediate decays have been removed for clarity. Though the intermediate daughter isotopes have shorter half-lives than uranium-238, they are continuously resupplied by decay of isotopes farther up the chain. The current results indicate that sufficient time has passed for thorium-230 and uranium-234 to be in equilibrium with uranium-238, which requires at least 1 million years.

As this equilibrium takes over 1 million years to establish, we know that these stalagmites are at least that old – and possibly much older. In order to determine precisely how old these samples are, geochemists are currently attempting to measure the accumulation of lead-206, the stable end of the decay chain.

This dating was conducted as a part of a larger project led by geochemists at Massachusetts Institute of Technology, the University of Minnesota and the University of Arizona. These investigators seek to use Lehman Cave's large collection of broken stalagmites to reconstruct past climate changes in the Great Basin. The abundance of different isotopes of oxygen in rain and snow reflects changes in the seasonality and amount of precipitation in the region, and these isotopic changes are recorded by the cave's stalagmites.

By dating stalagmites using uranium and thorium isotopes and measuring their oxygen isotopic composition, geochemists can build long-term, precisely dated records of past changes in water availability in the region. Though it is generally known that this region was much wetter during past ice ages and has been dry during warm periods, little is known about just how variable or how dry past warm periods have been. By building better paleoclimate records, these scientists hope to improve our understanding of controls on the region's climate.

Lehman Caves Stalagmite Gives Ice Age Clues

By Jeremy Shakun, Harvard University

What caused the ice ages?
This simple question has had geologists puzzling about global climate change ever since the mid-1800s when they first realized gigantic glaciers once stretched as far south as Seattle and New York.

The first answers came from a surprising place – not the icy realms of the north, but the muddy floor of the tropical ocean. As it turns out, the chemistry of little seashells accumulating on the sea floor over the millennia have recorded the history of massive polar ice sheets.

The link from seashell to ice sheet is straightforward. To grow an ice sheet requires snow to pile up winter after winter, which comes from moisture evaporated from the ocean. The water used to build ice sheets, however, is slightly different from the water left behind in the ocean.

While all water is H_2O, there are two kinds of oxygen (O) out there – O-16 and slightly heavier O-18. As you might imagine, it is easier to evaporate H_2O containing O-16 than O-18. So when an ice age comes around and points its snow guns on Canada, it takes more O-16 from the ocean to build the ice sheets and leaves more O-18 behind. In this way, the amount of O-18 relative to O-16 in seawater provides a gauge for the size of ice sheets on land, and this signature is imprinted in the chemistry of seashells built from

This stalagmite from Lehman Caves has been sectioned and polished. The addition of layers of calcite make lines, similar in appearance to tree rings. Dating different sections of the stalgmite and measuring the oxygen isotope content in them allows researchers to infer long-term climate patterns.

seawater. As these seashells pile up on the seafloor over time, they provide a history book of the ice ages.

When oceanographers first read through this seafloor history book in the 1970s, they made a remarkable discovery. They found that ice ages over the past million years came and went at cycles of 20, 40, and 100 thousand years.

The earth's orbit around the sun is not constant, but wobbles, rocks back and forth, and stretches and squeezes at exactly these same cycles. This correlation between ice age and orbital rhythms was uncanny and it seemed clear that the ice ages had been caused by these slow cycles in the amount of sunshine striking the planet.

There was one small catch though. Seafloor sediments are notoriously difficult to date, and so while scientists had a good idea of roughly how many ice ages occurred over the past million years, and therefore about how far in time they were spaced apart, they did not know the precise timing of any particular ice age. Given the remarkable coincidence between the length of the ice age and orbital cycles, however, this detail did not seem like much to worry about.

Trouble struck in 1988. A group of researchers cored through the side of a water-filled crack in the ground made of the mineral calcite at Devils Hole, Nevada and analyzed its O-18 content.

They found a pattern of O-18 variations almost identical to those seen in the deep-ocean seashell record, suggesting that they were looking at their own history book of the ice ages. But there was one

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key difference: the Devils Hole record could be dated with unprecedented precision – this was a history book with page numbers. And they found a big problem for the new orbital theory of the ice ages – the end of the second-to-last ice age in Devils Hole occurred 140 thousand years ago, but the earth's orbit around the sun did not cause the amount of sunlight hitting the ice sheets to rise until 130 thousand years ago, a full 10 thousand years later. This was a head-scratcher. If cycles in the earth's orbit drove the ice ages, how could an ice age end 10 thousand years before the orbital shift thought to trigger it? The effect seemed to come before the cause.

The geological community went into a frenzy, with some getting ready to throw away their still adolescent ice-age theory and others fiercely examining the Devils Hole record looking for defects. After a few years of debate no big holes were found in the Devils Hole argument, but the weight of the deep-sea mud record kept the orbital theory alive and well, and the problem began to collect dust rather than move toward a resolution.

It is now two decades later and, with the growing societal interest in climate change, there has been an explosion in research on past climate events. This work has shown that the ice ages were almost certainly linked to earth's orbital cycles. Still, Devils Hole has remained a curious thorn in the side of the orbital theory and, if it is correct, tells us at least that a final ice-age theory will not be a simple one. But is it correct? A recent study based on a stalagmite from Lehman Caves by Jeremy Shakun, a paleoclimatologist at Harvard University, and colleagues suggests otherwise.

Cave stalagmites are amazing time capsules of climate data, recording information on temperature, precipitation, and vegetation as they grow drip by drip, layer by layer upward from the cave floor. Stalagmites can also be dated more precisely than almost any other geological material. For instance, they can pinpoint the timing of an ice-age event 130 thousand years ago to within a few centuries.

Shakun's team analyzed the O-18 content up the length of the Lehman stalagmite and found a big jump, as big as the end of the ice ages in the Devils Hole record in fact, implying that the stalagmite is also recording the end of an ice age. The age of the stalagmite is the really interesting part though. As luck would have it, it dates right to the time interval of controversy at the end of the second-to-last ice age.

Surprisingly, the stalagmite places the end of this ice age 130 thousand years ago, just when the orbital theory predicts, but 10 thousand years later than in the Devils Hole record. This is another head scratcher because Devils Hole is in southern Nevada, only a few hundred miles from Lehman Caves. Although one could obviously have a sunny day while the other is getting rained on, it is hard to see how something as big as the end of an ice age could happen 10 thousand years apart in these two places. One of them must be wrong. Unfortunately, with only two samples, this is a case of "he said, she said," and it is not clear which, if either, climate record is telling the truth.

If Devils Hole is wrong then maybe the ice ages are not quite as complicated as it suggests. If the Lehman Caves stalagmite is mistaken, on the other hand, then our planet's climate system might be as difficult to understand as the Devils Hole record has been. As we stand on the brink of another global climate change in the 21st century, figuring out which of these two scenarios is right might tell us something about our hopes of predicting the warmer world we are entering. The only solution will be to find more stalagmites from the area and see which story they corroborate.

This might turn out to be a tough task though. Shakun's group dated several other stalagmites from Lehman Caves but none grew during this particular time interval around 130 thousand years ago. And because the underground cave environment is so stable it preserves formations extraordinarily well, so there is no way to tell the age of a stalagmite except to analyze it back in the laboratory. At least one thing is for sure though - while the answer might be a needle in a haystack, it lies in a stalagmite in a cave.

A Point in Time

By Eva Jensen, Cultural Resource Manager

In archaeology a *midden* refers to a place where people discarded refuse including broken pottery, torn textiles, ashes, bones, and sometimes broken tools. Projectile points are some of the oldest and most enduring and recognizable artifacts from a midden. The size, shape, and stone material of the points provide information about how people traveled, hunted, and made a living for the past 13,000 years.

Park archaeologists identify these points during routine survey and inventory for Park projects. This information provides direct evidence of human use of the changing environments in Great Basin National Park over long periods of time.

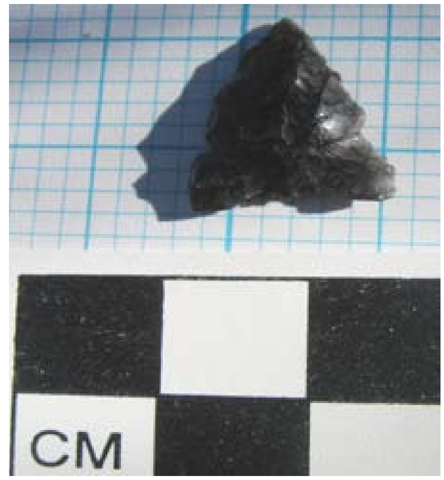
Often called arrowheads, these specialized stone tools are found in a variety of forms and sizes. Archaeologists refer to all of these forms as *projectile points*. Often the classic "arrowhead" shapes were used to tip the end of throwing spears or atlatl darts. The smallest of the stone points were the most recent, and provided the piercing point of arrows fired from a drawn bow. (These are the only true *arrowheads.)*

The shape and size of projectile points changed through time. The projectile point forms and associated technology also indicate what resources were available. During the Archaic period, larger game such as bighorn sheep were favored prey. Projectile points were used on throwing spears and darts (Figure 1). The darts were thrown with the *atlatl,* a tool that provided a lever action for added force and accuracy. Some of the identified Archaic points found in the Park are the *Elko* series points. Elko points span a range from 2,000 to 6,000 years ago.

NPS Photo

Figure 1. This projectile point was found in an isolated location near one of the many drainages of the South Snake Range. Although the tip is broken off, the shape of the base is a typical Elko type point from the Archaic period ranging from 2,000 to 6,000 years old.

Smaller, lighter points were hafted onto light flexible arrows after adoption of bow and arrow technology about 1,600 years ago. These *arrowheads* were used in the Late Archaic or Formative/Ceramic period. The Fremont and the later Paiute and Shoshone people shaped *Parowan, Cottonwood triangular* (Figure 2), *and Desert side-notched* points. The arrows provided light quick tools for hunting both larger game and smaller prey, such as antelope, deer, rabbits, and birds.



NPS Photo

Figure 2. This small point is a Cottonwood triangular style used on lightweight arrows. These points were used from 150 to 1,000 years ago.

Projectile points found within the Park are made from a variety of stone materials (Figure 3). Researching the tool stone source provides information about travel and trade over thousands of years. For example, obsidian was commonly used to make projectile points throughout all time periods. This volcanic glass is not found within the Park. Chemical tests can identify the stone source locations for obsidian projectile points. Obsidian points found in the Park have been traced to sources in Lincoln County, Nevada, northern Utah, and southern Idaho. This indicates that some of the earliest stone tools found in the park were carried hundreds of miles by people walking and hunting in the Great Basin.

Please remember that projectile points and all artifacts are important for archaeologists

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A Point in Time (cont.)

NPS Photos

Figure 3. These projectile points were made from a variety of tool stone material. Top photo is chalcedony, the white point base is chert, and the small arrow point is obsidian.

in understanding the past. All artifacts are protected by law. Do not move or remove any artifacts. Enjoy and photograph them. Each piece of stone tool, pottery, or glass is a clue to how people lived in Great Basin National Park in the past.

New Plants Added to Park List

By Glenn Clifton, Independent Botanist

Botanists create plant lists for areas to catalogue what lives there. Plant lists for the Snake Range were developed by Mont E. Lewis in 1973, Robert S. Price in about 1976, and Dr. Richard Shaw, no date on publication. Glenn Clifton started working in the area about 1984, at which time he decided to include the whole ecosystem, extending to the adjacent valleys. This area covers about 2,300 square miles, a little over 2% of Nevada's land mass. He has walked or driven over thousands of acres to study the plants in the area and create a *Flora of the Snake Range*. He has collected a few thousand sheets of voucher specimens, which have been placed at Pacific Union College, his own private herbarium, and the Park's herbarium. This work was funded by the author, the National Park Service and other agencies.

Photo by Glenn Clifton

Woolystar (*Eriastrum signatum*), added to the park list in 2011.

For its size, the ecosystem is very diverse in the number of named plant types (1000+), which is about 29 percent of all the plant types found in Nevada. This diversity is due to the southern Snake Range containing the second highest peak in the State of Nevada and large wetlands in the adjacent Spring and Snake valleys. The ecosystem supports a number of plants that are apparently only found here and nowhere else in the State. Several species are found nowhere else in the world.

Despite over 25 years of work in the area, the author is still finding additional species. In June 2011 he added twenty-five species to the park plant list. Of these, five were new for the Snake Range, including Alyssum (*Alyssum simplex*), Diffuse collomia (*Collomia tenella*), Woolystar (*Eriastrum signatum)*, Nevada gilia (*Gilia brecciarum*), and Rock melicgrass (*Melica stricta*).

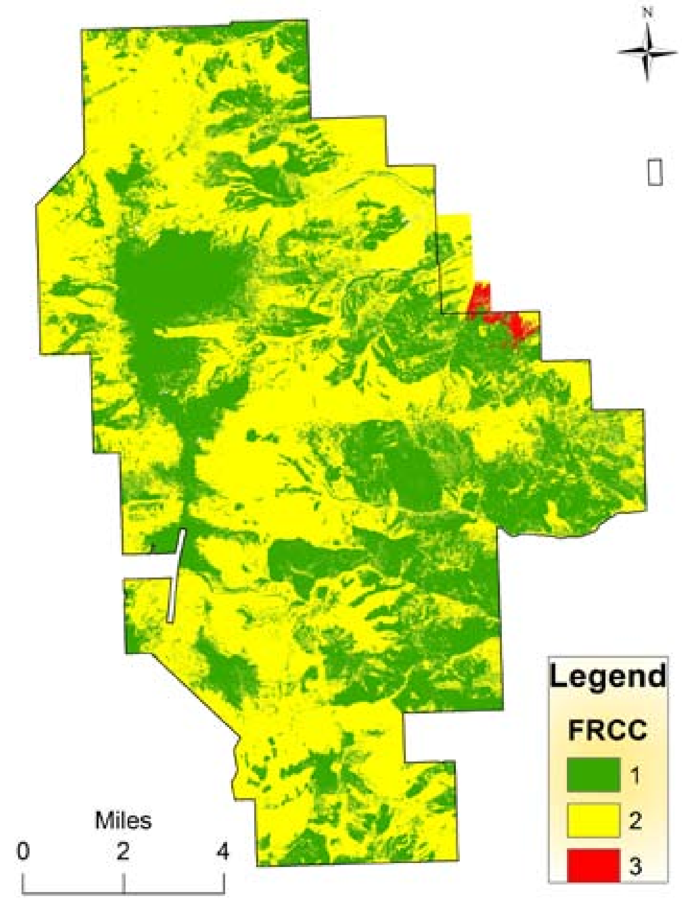
Photo by Glenn Clifton

Diffuse collomia (*Collomia tenella*) is one of the new species added to the park and Snake Range list in 2011.

Using Fire Regime Condition Class to Prioritize Restoration

By Bryan Hamilton, Wildlife Biologist

Great Basin National Park was established to preserve unimpaired a representative segment of the Great Basin and manage the park to maintain the greatest degree of biological diversity and ecosystem integrity. Fire is an important agent of disturbance and in many plant communities fire increases biological diversity, maintains early seral state plant communities, increases habitat heterogeneity, and increases ecosystem productivity and nutrient cycling.



Map of Fire Regime Condition Class (FRCC) in Great Basin National Park. FRCC 1 (green) are areas that are generally healthy, while FRCC 3 (red) indicate systems that are most in need of restoration.

Recognition of the importance of wildfires to ecosystem processes has led to incorporation of fire into management and restoration in national parks. Utilizing fire as a management tool and returning fire to the ecosystems requires good information on the role of fire in the various ecosystems and the current condition of fuels.

Fire Regime Condition Class (FRCC) is an interagency, standardized tool for determining the degree of departure from reference condition of vegetation, fuels and fire regimes. Fire Regime Condition Class (FRCC) is used to group ecological departure scores into three classes: FRCC 1 represents ecological systems with low (<34%) departure; FRCC 2 indicates systems with moderate (34 to 66%) departure; and FRCC 3 indicates systems with high (>66%) departure.

The Nature Conservancy, though a Southern Nevada Public Lands Management Act project funded by the Eastern Nevada Landscape Restoration, recently mapped vegetation and determined ecological departure and FRCC in Great Basin National Park.

At a landscape level, Great Basin National Park is in excellent ecological condition. The majority of the landscape falls in FRCC 2 (62%) or FRCC 1 (38%). Although most of the park is in excellent condition several ecosystems are approaching FRCC 3. Aspen-mixed conifer was 66% departed and fell into FRCC 2. However without active management, specifically prescribed fire or wildland fire use, most of this biophysical setting will convert to FRCC 3. Aspen is a fire dependent ecosystem, maintained by frequent disturbance; further exclusion of fire will effectively eliminate aspen from the park at a landscape scale.

Utilizing this state of the art information, Great Basin NP is planning for a landscape scale vegetation management plan that will include fire as an integral part of ecosystem dynamics. A small prescribed fire is currently being planned to restore aspen ecosystems on the west side of the park.

Kious Basin Ecological Restoration Project

By Tod Williams, Chief of Resource Management

Aspen and sagebrush habitats are important to the natural history of the Great Basin. Both habitats have declined across the region due to grazing, fire exclusion and conifer encroachment.

Conifer encroachment in Great Basin National Park has reduced sagebrush habitat by 60% and aspen habitat by 80% from historic conditions. Given the current successional trajectory of fire exclusion, conifer encroachment, and annual grass invasion, both habitat types are at high risk of being lost from the landscape.

Over the next two years, the Kious Basin ecological restoration project seeks to restore 500 acres of sagebrush habitat and 25 acres of riparian aspen across jurisdictional boundaries on the NPS and BLM. These restoration actions will benefit pronghorn, pygmy rabbits, elk, sage-grouse, goshawks and migratory songbirds.

The project area is located within two miles of the only known lek site in Snake Valley. Conifer encroachment has excluded use of park lands by pronghorn antelope. It is hoped that this project will allow these species to once again use the restored areas as summer and winter habitat.

A major goal of working across administrative boundaries is restoring connectivity between habitat patches, allowing wildlife populations to expand into new habitat. Additionally this project would reduce fuels on 111 acres of wildland urban interface along the park boundary and would convert 525 acres of fire regime condition class (FRCC) 2 to FRCC 1.

NPS Photo

Thinning in the pinyon and juniper area in Kious Basin is restoring sagebrush habitat, which will benefit a variety of animals.

National Park Service
U.S. Department of the Interior

The Midden is the Resource Management newsletter for Great Basin National Park.

A spring/summer and fall/winter issue are printed each year. *The Midden* is also available on the Park's website at www.nps.gov/grba.

We welcome submissions of articles or drawings relating to natural and cultural resource management and research in the park. They can be sent to:
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Or call us at: (775) 234-7331

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New Fly Species Announced

by Gretchen Baker, Ecologist

A new species of fly has been found in the park. It was recently identified and described in the journal *ZooKeys* by taxonomists Pekka Vilkamaa of Finland and Heikki Hippa of Sweden along with cave biologist Steve Taylor from the Illinois Natural History Survey.

The new fly belongs to the order Diptera (flies) and family Sciaridae (dark-winged fungus gnats). Its scientific name is *Captochaeta prolixa*. *Prolixa* means stretched out, referring to the very long extremities of the fly. *Camptochaeta* is Latin for "flexible, long hair."

Photo from entomology.umn.edu

The new species of fly is in the family Sciaridae, the Dark-winged Fungus Gnats.

Most Sciaridae eat fungi or decaying organic matter and like moist environments.

Of note, this species is very similar to species found in European and Russian caves. Ten of the eleven specimens of *C. prolixa* were collected in the dark zones of the caves (Lehman, Root, and Lehman Annex Caves). The type locality is Root Cave, so the common name for this fly is Root Cave Dark-Winged Fungus Gnat.

Additional new species of cave flies are expected to be forthcoming as experts have time to closely study them.

You can help look for new fly species in the 2012 Bioblitz, which will concentrate on flies. Join us June 19-21 and help us learn more.

What's a midden?

A midden is a fancy name for a pile of trash, often left by pack rats. Pack rats leave middens near their nests, which may be continuously occupied for hundreds, or even thousands, of years. Each layer of trash contains twigs, seeds, animal bones and other material, which is cemented together by urine. Over time, the midden becomes a treasure trove of information for plant ecologists, climate change scientists and others who want to learn about past climatic conditions and vegetation patterns dating back as far as 25,000 years. Great Basin National Park contains numerous middens.

Upcoming Events:

February 17-20: 15th Annual Great Backyard Bird Count. Improve your birding skills and contribute to science! See http://www.birdcount.org

April 14: Great Basin Spring Star Party. Special program & night sky viewing with telescopes. See http://www.nps.gov/grba for more details.

May 26 & 27: Memorial Day Weekend Star Party. Enjoy the dark skies!

June 5: Transit of Venus Party. Special program & night sky viewing

July 14-16: 3rd Annual Astronomy Festival. Join hundreds of star gazaers for a fun filled weekend. Excellent sky-viewing opportunities and a variety of programs and talks offered. See http://www.nps.gov/grba for more details.

June 19-21: Diptera Bioblitz. Help collect flies to add to the baseline data on invertebrates in the park. Email Gretchen_Baker@nps.gov for more details.

Lehman Cave Tours daily at 9 AM, 11 AM, 1 PM, and 3 PM. Additional tours are added during busy periods.
Visitor Center open daily except Thanksgiving, Christmas, and New Years Day.

Great Basin National Park