**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

## Lichen BioBlitz Adds New Insights into Distribution

By Bradley Kropp, Utah State University

The Lichen BioBlitz held July 17-19, 2017 at Great Basin National Park (GBNP) attracted roughly 50 participants. In addition to a handful of professional biologists who specialize in lichens, the participants came from a wide range of backgrounds and included some youth and a few local residents. Most of the participants had little or no prior knowledge of lichens but all brought an enthusiasm for natural history and an interest in learning.

**Wolf lichen (*Letharia vulpina*), one of the many lichens seen during the 2017 BioBlitz. This lichen is found on dead wood of bristlecones. Overall, few tree lichens were found during the BioBlitz.**

Dr Steve Leavitt of Brigham Young University and I led the BioBlitz. On the opening day of the BioBlitz, Steve Leavitt gave a talk to attendees explaining what lichens are and covering important aspects of their biology and identification. I followed up with a talk outlining what was known about lichens in GBNP prior to the BioBlitz and suggested areas or habitats that could be explored during the BioBlitz. On the final day we gave a joint presentation summarizing the results of the BioBlitz.

An important goal of the BioBlitz was to build the list of lichens in the park that had already been put together during a survey that I conducted a couple of years prior Even though work on identifying the lichens collected during this summer's BioBlitz hasn't yet been finalized, I hope to briefly summarize below some of what we have learned about the lichens of GBNP.

Many of the lichens collected during the BioBlitz were already known to be present in the park. Because of that, BioBlitz participants have probably added relatively few new species to the park list. However, situations like this can have a silver lining in that the new species that end up being found are sometimes things that are especially interesting.

*Continued on Page 2*

**Dr. Steve Leavitt showing a lichen during the 2017 BioBlitz.**

**This tiny *Cladonia* species of lichen has small stalks.**

## In This Issue

# Lichen BioBlitz (continued)

For example, Nevada is hardly the place one would expect to find aquatic lichens. I was surprised to find two aquatic species near Wheeler Campground during my first survey. However, two more aquatic lichens were added to the park list during the BioBlitz. Both of these were species of *Dermatocarpon* that tend to be foliose (leaf-like) and grayish-green in appearance. One of these that is fairly inconspicuous and grows on rock in Baker Creek was nearly overlooked. When it was first pointed out, I simply dismissed it as a liverwort! However, a closer look revealed that it was in fact not only a lichen but one that was new to our list.

**Dr. Brad Kropp climbing up on a rock outcropping to take a closer look at some lichens.**

Another interesting aspect of the lichen communities found in GBNP is that there are so few lichens on trees. Only about 26 species have been found on trees in the park thus far. In most environments, lichens on trees are abundant and in many instances they are dominant enough to account for most of the species present. It is well known that air pollution negatively affects lichens on trees but that is not a major factor in eastern Nevada. The best explanation for the absence of lichens on trees appears to be the aridity of the Great Basin.

The most species-rich and common groups of lichens in GBNP are the crustose lichens (i.e., those growing tightly on their substrates) on rock. These are often colorful and fascinating lichens. However, they are challenging to identify given that extensive microscopic work is typically needed to name them and few good identification resources are available.

Overall, at least 123 lichen species are known to occur within park boundaries. There is no doubt that more are present, and quite a few will be added when the results of the BioBlitz are finally tallied. Between my survey and the BioBlitz, most of the plant communities and the major geological formations in the park have been explored. The most promising remaining areas for locating additional species appear to be at the southern end of the park where numerous geological formations intersect and road access is more limited.

**Many of the participants at the 2017 Lichen BioBlitz. Attendees spanned all ages and came from several states.**

# Red Fox (*Vulpes vulpes*) in Great Basin National Park

By Preston Alden, University of California-Davis

An evolutionarily distinct lineage of red fox native to the Western United States occurred historically in isolated populations scattered among high-elevation sky islands of the Great Basin and surrounding mountain ranges. These Pleistocene relictual populations are disappearing as their subalpine habitats are lost to climate change and other anthropogenic causes. Great Basin National Park (GBNP) is becoming an increasingly important refuge for these and other relictual sky-island species. Additionally, these native foxes are threatened by introduced nonnative foxes at lower elevation that hybridize with native populations and appear to be increasing in number in recent decades.

Little was known about the current range-wide distribution of remaining native Great Basin red foxes prior to our research in 2015. We verified with genetic scat samples that red fox within GBNP clustered more closely with the Rocky Mountain subspecies of red fox (*Vulpes vulpes macroura*) and not with the Sierra Nevada red fox population (*Vulpes vulpes necator*). In addition, comparison of red fox genetics across the greater Great Basin revealed that red fox within GBNP specifically might be remnants of a distinct subspecies of native montane red fox originating within the Great Basin itself (Figure 1).

Once native montane red foxes were identified within GBNP, the next step was to investigate the size of the population in the Park. We performed additional scat collection surveys and used previously collected data to make a population estimate. Using a mark-recapture analysis of 25 DNA scat samples from 10 individuals, we estimated the population to be 11 to 15 individuals. This small population estimate is likely a result of native montane red fox behavior. These foxes tend to persist in small family groups in subalpine habitat.

Future research is needed to better understand the historical and contemporary connectivity of red fox in GBNP to other native and expanding nonnative red fox populations. This research highlights the conservation value for the species both in and out of GBNP and provides an excellent opportunity to better understand how climate change affects population genetics on a large scale.

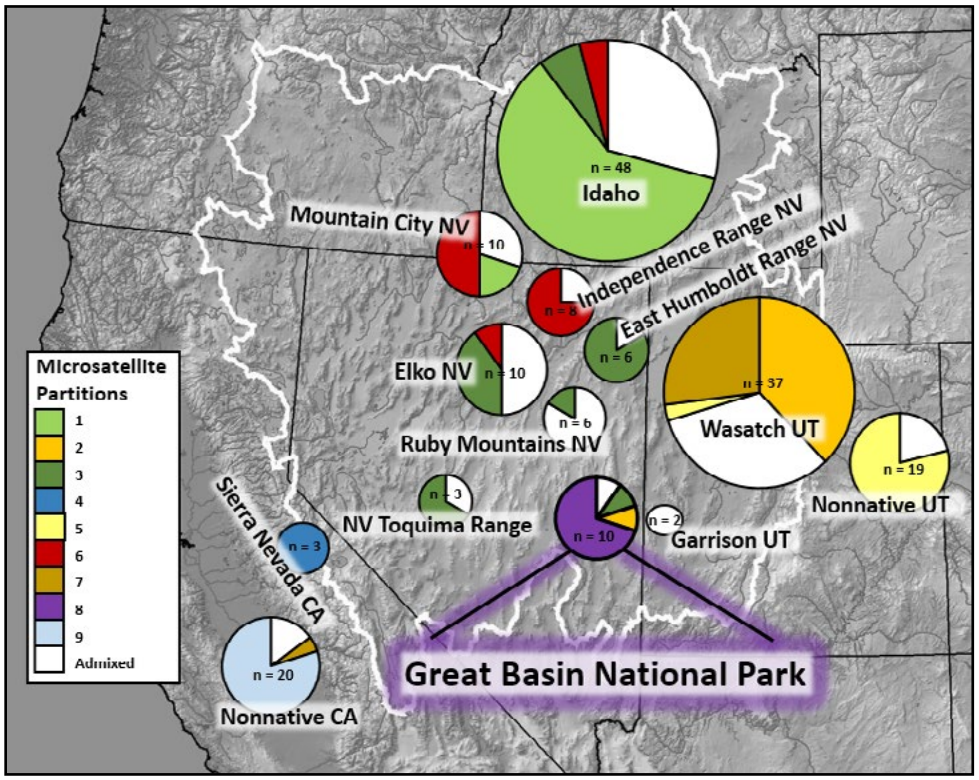



**Figure 1. Comparison of red fox populations across the Great Basin and surrounding areas using nuclear DNA (microsatellites) with 9 partitions, i.e., presumed number of populations. Note: Great Basin National Park contains a unique group (purple).**

**You're invited!**

**Beetle BioBlitz**

**June 12-14, 2018**

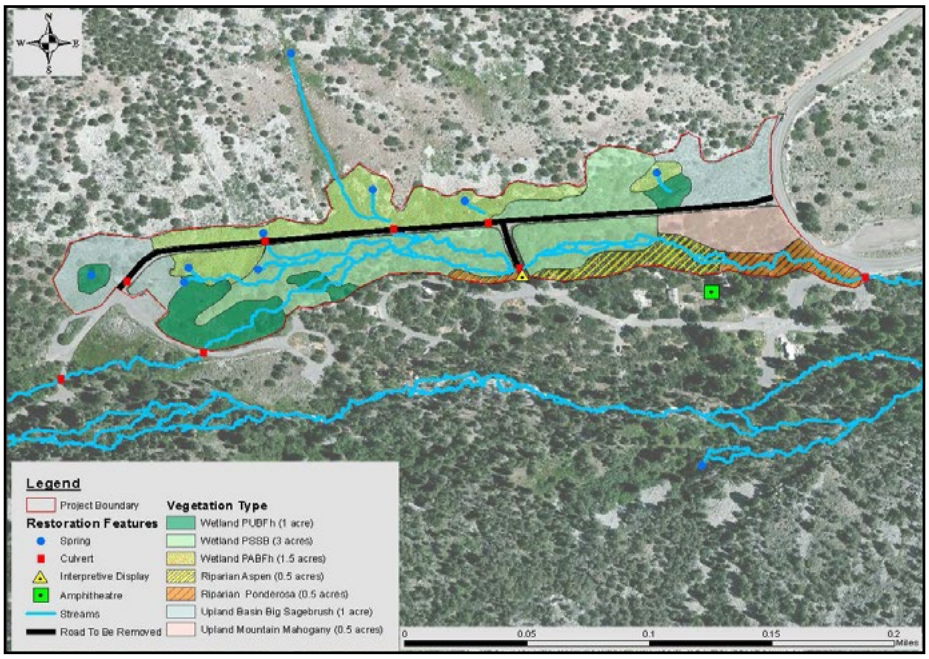
Join Nevada State Entomologist Jeff Knight and other experts to learn more about what beetles live in the park.

Email GRBA_Bioblitz@nps.gov to be added to the mailing list.

# Upper Lehman Wetlands Restoration

By Tod Williams, Chief - Resources and Planning

The Upper Lehman Campground was developed in the 1960s by the U.S. Forest Service. The area of the northern campground access road was originally a wetland complex consisting of springs, seeps, wet meadows, and a braided riparian stream system. A road was graded in, covered with several feet of road base, and then paved. To redirect water from both the road and nearby campsites, ditches were constructed to drain wet areas and channel water through five culverts. A perennial tributary was placed in a 20 meter long ditch and diverted into the main steam of Lehman Creek.




**Map of project area for the Upper Lehman Wetlands Restoration. The black line shows the road that was removed. Blue lines indicate streams.**

The existing conditions showed that wetland functions and values were compromised. Wetland function was eliminated or degraded, native vegetation was reduced, and hydrologic function was impacted due to the diversion of natural flow patterns. Loss of hydrologic function was by far the largest impact. Wetlands and riparian habitat are extremely limited within the park, but because of their outsized ecological footprint, are typically valued more than other ecological systems.

The campground was reconstructed in 2015. Resource staff worked with the design team to eliminate the need for the northern access road. Thus the opportunity to restore the wetland complex began. A proposal was submitted to Round 15 of the Southern Nevada Public Lands Management Act as a Conservation Initiative and funded for a four-year period. The primary deliverables for the project included:

-Restore one-half mile of riparian stream habitat to proper functioning condition
-Restore eight acres of wetland habitat to proper functioning condition
-Decommission one-third mile of road and restore native ecosystems-Monitor biological communities to document restoration success.

All wetland and riparian types showed evidence of adverse impacts due to channelization and loss of water. There are seven mapped ecological systems within the project area. Five of these will benefit from the project:

- Wetland Type PUBFh is a palustrine system dominated by shrubs, grasses, sedges, and emergents with an unconsolidated bottom. It is a semi-permanently flooded system with surface water persisting throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land's surface.

- Wetland Type PSSB is a palustrine system dominated by woody vegetation, (aspen, Wood's rose, and water birch) that are small or stunted because of environmental conditions.

- Wetland Type PABFh is a palustrine system but is dominated by sedges and emergents that grow principally on or below the surface of the water for most of the growing season. It is semi-permanently flooded system with surface water persisting throughout the growing season.

- Riparian Aspen is dominated by quaking aspen with greater than 60% cover in unconsolidated sediments near permanent water. *Continued on Page 5*

# Upper Lehman Wetlands Restoration (continued)

**Recontouring streambanks after culvert removal**

**Road prior to road base removal**

**Re-contouring and base removal**

White fir may be present in the over story but the understory is dominated by wetland grasses, sedges, and forbs.

- Riparian Ponderosa is dominated by ponderosa pine with greater than 25% cover in unconsolidated sediments near permanent water. White fir and aspen may be present. This type is rare within the Snake Range due to heavy selective logging at the turn of the century and fire suppression resulting in low recruitment.

Wildlife: The species below depend upon wetlands and riparian stream habitat, are species of management concern, and were documented within the project area. All of the species would benefit from larger and proper functioning wetland and riparian habitats.

- Water shrew (*Sorex palustris*)
- Inyo shrew (*Sorex tennellus*)
- Ermine (*Mustela erminea*)
- Long-tailed weasel (*Mustela frenata*)
- Yellow-bellied marmot (*Marmota flaviventris*)
- MacGillivray's warbler (*Oporornis tolmiei*)
- Yellow warbler (*Dendroica petechia*)

Park resource and maintenance staffs have completed the second year of the four-year project. To date, all asphalt and road base have been removed; the site has been re-contoured; five culverts have been removed; ditches have been filled; all springs, seeps, and tributaries have been returned to their natural channels; pools were created within the three palustrine ecosystem types; 250 ponderosa pine seedlings were planted; and seed mixes were developed for each ecosystem with the initial planting occurring this fall. Additional re-vegetation efforts and invasive species control will be required during the next two years. Post-treatment biologic monitoring will continue in all areas. Of most interest, at least to the author, was watching the re-establishment of the hydrologic function. Upon removal of the asphalt, road base, and ripping out the old roadbed, water poured out of the hillside saturating the former wetlands. Springs and seeps surfaced in numerous areas along the length of the old road, reclaiming land after a fifty-year absence.

**Return of hydrologic function**

# Rattlesnakes Emerging Earlier Due to Warmer Temperatures

By Bryan Hamilton, Wildlife Biologist

We conducted a 17-year study of Great Basin rattlesnakes (*Crotalus lutosus*) at four communal hibernacula in eastern Nevada and western Utah. Surveys were conducted during spring emergence (March, April, and May) from 2000 to 2017. Hibernacula were visited approximately 10 times each year. We defined peak emergence as the date on which the greatest number of snakes were observed at a hibernaculum (sensu Brown 2008).

To determine peak emergence dates, we summed total captures per Julian day, by site and year. We then summed the total captures per Julian day across years and calculated the mean, median, and standard deviation of the dates of peak emergence. We also looked at the relationship between Julian day and mean April temperature using a simple correlation analysis.

Across all years, the mean date of peak captures occurred on 23 April. The mean peak capture date decreased by about one day per year (captures= - 1.1 (year) + 2250, df = $F_{1,15}$= 7.57, $P$ = 0.009, $R^2$ = 0.3371; Figure 1). This decrease was related to mean April temperature (r = 0.40). Higher April temperatures correlated with earlier emergence dates.

One of the strongest signals of climate change in the Great Basin is an earlier onset of spring (Chambers 2008). Earlier spring onset brings a suite of ecological effects including a reduction in snowpack (Mote et al. 2005), earlier stream run-off

**A Great Basin Rattlesnake**

(Stewart et al. 2005), and earlier plant phenology (Monahan et al. 2016). Our observations of earlier spring emergence of Great Basin rattlesnakes is consistent with predictions of a warmer and earlier spring. Stay tuned to *The Midden* and social media for more analyses of Great Basin rattlesnake data.

References


Brown, W. S. 2008. Sampling timber rattlesnakes (*Crotalus horridus*): Phenology, growth, intimidation, survival, and a syndrome of undetermined origin in a northern population. Pages 235-256 in W. K. Hayes, K. R. Beaman, M. D. Cardwell and S. P. Bush, editors. The Biology of Rattlesnakes. Loma Linda University Press.

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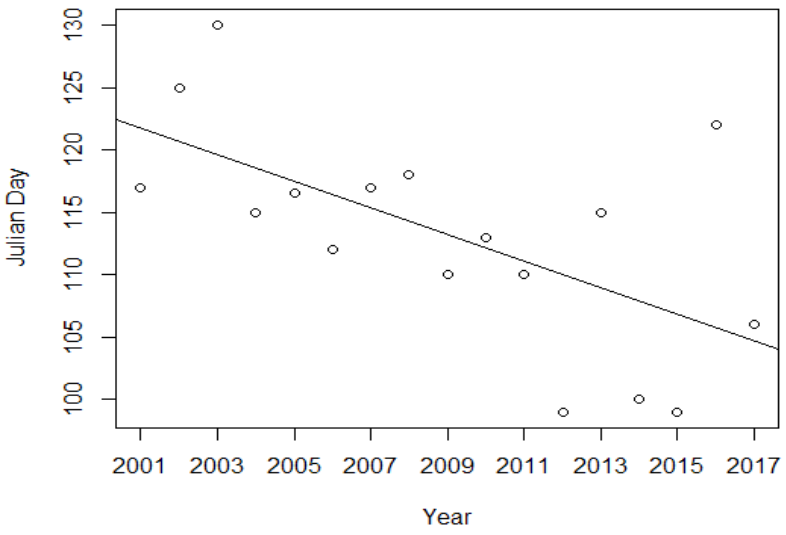


**Figure 1. Peak emergence date for rattlesnake emergence by year.**

# Monitoring & Treatment of Invasive Plants at Water Systems

By Julie Long, Biological Science Technician

At Great Basin National Park, four meadow complexes provide drinking water to visitors, park residences, and campgrounds. Wet meadows make up only 0.1% (87 acres) of the park, varying in elevations from 7,200 to 10,300 feet. These mesic habitat types seem more susceptible to invasion by non-native plant species due to available water and soil conditions. Invasive plants can alter fire regimes and outcompete native plant populations that are already adapted to the soil and surrounding habitat. This poses a threat to native plant communities, impacts forage for wildlife, and degrades soils.

Sites at Cave Springs, Baker Creek, Lehman Creek, and Wheeler Peak serve as collection sources for potable water, allowing manual (grubbing or pulling by hand) treatments on invasive plant species as the only appropriate mode of treatment. Use of herbicide treatments in these areas is prohibited because of the utilized resource – drinking water. There are over twenty-five non-native plant species in the park, but the four priority species for treatment were bull thistle (*Cirsium vulgare*), whitetop (*Cardaria draba*), musk thistle (*Carduus nutans*), and Canada thistle (*Cirsium arvense*).

**A rosette of a bull thistle. This early growth is monitored and treated by the invasive plant team in the park.**

Manual treatments were implemented from May to late September on five acres by two park employees. Four sites were visited twenty-two times and a total of thirty-one hours were dedicated to hand pulling invasive plants (Table 1). Each water source was surveyed in order to remove any invasive plants before they had time to flower or go to seed. The Lehman Creek and Wheeler Peak collection areas had no targeted invasive plant species present while Cave Springs and Baker Creek each had existing bull thistle populations. At Cave Springs a total of 0.2 acres, with about 461 bull thistle plants, were treated, and at the Baker Creek treatment site, six bull thistles were removed.

In order to reduce infestations and prevent the spread of non-native plant species, the park will continue to monitor and treat invasive plant species following integrated pest management practices to protect native plant communities and habitat.

**Table 1. The number of acres, visits, and time spent at four water collection sources.**

| Park Water Systems | Acres | Infested acres | Invasive plants | Number of visits | Hours |
|---|---|---|---|---|---|
| Cave Springs | 2.5 | 0.220 | C. vulgare | 8 | 16.6 |
| Baker Creek | 0.3 | 0.004 | C. vulgare | 6 | 5 |
| Lehman Creek | 2.2 | 0 | - | 5 | 7 |
| Wheeler Peak | 0.2 | 0 | - | 3 | 3 |
| Total | 5.2 | 0.224 | C. vulgare | 22 | 31.6 |

# Recent Publications


Gray, C. A. 2017. Impact of climate variability on the frequency and severity of ecological disturbances in Great Basin bristlecone pine sky island ecosystems. Doctoral dissertation, Utah State University.

Smithers, B. V., North, M. P., Millar, C. I., & Latimer, A. M. 2017. Leap frog in slow motion: Divergent responses of tree species and life stages to climatic warming in Great Basin subalpine forests. Global Change Biology.

Will, K., Madan, R., & Hsu, H. H. 2017. Additions to the knowledge of Nevada carabid beetles (Coleoptera: Carabidae) and a preliminary list of carabids from the Great Basin National Park. Biodiversity Data Journal, (5).

# Bats in the Basin and Beyond

By Kathleen Slocum, Biological Science Technician

**Releasing a recently banded Mexican free-tailed bat.**

Great Basin National Park's Southern Nevada Public Land Management Act funded project, "Can land managers prevent the 'inevitable collapse' of bats in the western US?" has just finished its first of five field seasons. The overarching goals of the project are to locate and protect important bat roosts, derive demographic information about local bat populations, and educate and engage the public in bat conservation. Data gathered will help managers both locally and regionally better mitigate the growing threats to bat populations and manage bat habitats.

What makes this project unique is its scale; the study area includes the valleys and mountain ranges adjacent to the park, and has interagency collaboration built into its framework. Before white-nose syndrome (WNS) spread to Washington state in 2016, White Pine County, NV in which Great Basin NP is located, was ranked the 10th most susceptible county west of the Mississippi for WNS based on potential roost sites, bat species, and climate suitability (Ihlo 2013). Millard County, UT, and Tooele County, UT both border White Pine County and were ranked in the top 14 counties for susceptibility. As complex threats to bats continue to affect our landscape, we hope commensurate efforts like this SNPLMA project will provide managers the necessary tools to conserve and protect bats at the landscape-scale.

A main focus of our efforts has been in deploying passive integrated transponder (PIT) tag arrays at several major Townsend's big-eared bat (*Corynorhinus townsendii*) maternity roosts, such as the one in Lehman Caves. Townsend's big-eared bats have been shown to host the WNS causative fungus, *Pseudogymnoascus destructans* (Pd). This species is also known to share roosts with other bat species that are susceptible to developing WNS.

Bats are trapped as they exit the roost and injected with a 12 mm-long PIT tag. A small computer and antenna then logs individuals as they enter and exit the roost. The dataset gathered will provide novel baseline information about the timing and fidelity of roost use by bats in and near the park, as well as important life history data like survival and recruitment. Similar arrays are on caves with Townsend's roosts managed by the US Forest Service and Bureau of Land Management within White Pine County.

The park is also helping with a mark-recapture project studying Mexican free-tailed bats (*Tadarida brasiliensis*) that roost in a cave close to the western park boundary from May-October. This species migrates in the spring and fall. The continental-scale connections between their roosts is poorly understood. Over the last three years, the Nevada Department of Wildlife and partners have outfitted 30,000 bats with wing bands, which uniquely identify them as part of our Nevada roosting population.

Migratory bats like Mexican free-tailed bats have been heavily impacted by wind-energy development; this project will better inform wind development and bat conservation as wind energy continues to expand across the West.

Landscape-scale bat studies are also becoming a focus within the Mojave Inventory and Monitoring Network. The first network bat blitz

*Continued on Page 7*

## Bats (continued)

was performed at Grand Canyon-Parashant National Monument this past June. The area is a junction of the Colorado Plateau and Mojave ecoregions, very remote, and is incredibly biologically diverse. Twenty-five participants from the NPS, Arizona Game and Fish, and university partners performed three nights of trapping at 11 sites. Twelve species were caught in the hand, and there were potentially two more captured acoustically. The blitz was highly successful at providing a baseline assessment of bat diversity in that park and region. Aside from the science, a profitable aspect of this bat blitz was the strong emphasis on intra-agency networking. A great foundation was built for future bat work in the network parks.

Reference

Ihlo, C. M. 2013. Predicting the spread of white-nose syndrome in bats. PhD diss., Duke University.

**Bat found in one of the park caves.**

*Want to help the park learn more about birds? Join us for the Christmas Bird Count on December 18, 2017!*

## Forgotten Grasslands: Basin Wildrye

**Basin Wildrye is a native grass that will be the focus of a restoration project.**

By Gretchen Baker, Ecologist

Basin wildrye (*Leymus cinereus*) is an easy-to-recognize grass. It stands up to six feet tall, and early pioneers that arrived in Snake Valley commented on how it rose up to their horses' bellies. It was an abundant grass, but that is no longer the case. Basin wildrye ecosystems have been severely degraded by fire suppression, timing of grazing, conversion to agriculture, and introduction of nonnative plants. In Great Basin National Park, this degradation has resulted in the conversion of a large proportion of wildrye communities to areas dominated by non-native grasses and woody vegetation.

The Nature Conservancy (TNC) used soils data and satellite imagery to map plant communities to a one-meter resolution. They determined that 268 acres in the park is a basin wildrye ecosystem. This ecosystem was identified as the most endangered plant community in Great Basin National Park through a park-wide watershed analysis and conservation planning assessment process.

Fortunately, basin wildrye communities are highly recoverable. The park applied for a Southern Nevada Public Lands Management Area grant for five years. The first year has been spent completing archeological clearance. During years two through four, we will restore 90 acres of basin wildrye, 80 acres of sagebrush, and 45 acres of riparian habitat through a combination of planting, seeding, chemical, and mechanical treatments. These management strategies were recommended by TNC as a key restoration action in restoring park plant communities to desired condition.

The project area is near Lehman Creek from the park boundary up to Upper Lehman Campground and the lower part of the Lehman orchard. We expect to start treatments this winter.

**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:
Resource Management,
Great Basin National Park,
Baker, NV 89311
Or call us at: (775) 234-7331

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## 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.

Great Basin National Park

# Save the Date! Beetle BioBlitz in 2018

**The next BioBlitz is scheduled for June 12-14, 2018, and will focus on beetles (Coleoptera).**

Join us for our tenth annual BioBlitz! We started with beetles in our first BioBlitz, and we're going to return to them during a different part of the year to see what else lives in the park. Nevada State Entomologist Jeff Knight, along with other experts, will help guide citizen scientists during this fun, science-filled three-day event. We'll be looking for beetles day and night. This event is timed to coincide with the new moon so light traps will be even more effective. There is no cost to attend the BioBlitz. The Beetle BioBlitz will support learning about biodiversity in our national parks and include beetle walks, talks, art, and other activities.

Did you know:

- Over 300,000 species of beetles are known to exist. This is about 40% of all known insect species.
- Ladybird beetles (ladybugs) are a type of beetle that help to control pest populations by feeding on aphids that would otherwise eat vegetable plants.
- Dung beetles are very important in many ecosystems because they feed on animal droppings. They recycle waste material and speed up the circulation of nutrients back into the food chain.
- Humans eat more beetles than any other kind of insect. There are over 300 species known to be eaten, with most of these eaten at the larvae stage.

**A long-horned beetle is one of the many denizens of the park.**

Email GRBA_BioBlitz@nps.gov for more info.

## Upcoming Events:

**December 18: Snake Valley Christmas Bird Count** Help count birds in the longest-running citizen science project. We welcome volunteers of all experience levels. Contact Gretchen_Baker@nps.gov.

**December 19: Ely Christmas Bird Count** Help discover what birds live in and near Ely. Contact Nancy Herms at nherms@blm.gov

**February 6-8, 2018: Lehman Caves Lint and Restoration Camp** Spend time uncovering the beauty in Lehman Caves. Contact GRBA_Lint_Camp@nps.gov for more info.

**February & March 14, 2018:** Learn more about caves in this US Forest Service-sponsored video and live question and answer event. You may even see someone from the Great Basin onscreen! Check out http://caveslive.org/

**June 12-14, 2018:** Join us for the tenth annual BioBlitz, focusing on Beetles. Email GRBA_BioBlitz@nps.gov to get more info and sign up.

**Throughout Winter:** Cave tours at 1 p.m. on weekdays and 9 a.m. and 1 p.m. on weekends. Reserve your spot in advance at Reservation.gov.

**Throughout Winter:** Check out the backcountry on snowshoes! Rentals available at the Lehman Caves Visitor Center, 8:30 a.m. to 4 p.m. daily.