**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 Diversity in Great Basin National Park

by Steve Leavitt, M.L. Bean Life Science Museum & Department of Biology, Brigham Young University and Bradley Kropp, Biology Department, Utah State University

When a lichen that had been known only from Antarctica and the High Arctic, *Lecidea andersonii*, turned up in collections made in Great Basin National Park during a BioBlitz in 2017, it became clear how little is known about lichen diversity and distributions in the Great Basin.

*Lecidea andersonii* is just one of the 233 lichens that were recently documented in the first checklist of the lichens of Great Basin National Park. This checklist marks an important landmark in characterizing lichen diversity in the Park.

While finding unusual lichen specimens is not uncommon when examining field collections of these underexplored lifeforms in the lab, the overall lichen diversity in Great Basin National Park is particularly striking. Surveys near Wheeler Peak revealed a 4:1 ratio of lichens to vascular plants; and diverse lichen communities are found throughout the Park's diverse ecosystems.

Some lichens, such as the elegant sunburst lichen (*Rusavskia elegans*), green rock posy (*Rhizoplaca melanophthalma*), and sunken disk lichens (*Aspicilia sensu lato* species), are commonly found from alpine to sage-steppe habitats in the Park.

In other cases, extreme differences in lichen communities are observed. The alpine lichen communities on Mount Washington (3553 m.a.s.l.) and Wheeler Peak (3982 m.a.s.l.) are noticeably distinct in terms of species composition and diversity, largely due to differences in rock substrates. In fact, the Prospect Mountain Quartzite on Wheeler Peak harbors at least 38 rock-dwelling lichens in comparison to the eight documented lichens occurring on the Pole Canyon Limestone comprising the summit of Mt. Washington.


Photo by Steve Leavitt

**This lichen, *Lecidea andersonii*, was previously known only from Antarctica and the High Arctic, but was found during the 2017 BioBlitz in Great Basin National Park.**

The majority of the lichens in the Park occur on rock surfaces or

*Continued on Page 2*

Photo by Steve Leavitt

***Rhizoplaca melanophthalma* (green rock posy) is a common lichen found throughout the park.**

## In This Issue

# Lichen Diversity (continued)

live inside rock with only fruiting structures appearing on the rock surfaces, e.g. endolithic lichens. Diversity of these endolithic lichens has been particularly fascinating.

In addition to *Lecidea andersonii* – the putative Arctic and Antarctic endemic – other endolithic lichens that were previously known from Subantarctic regions in Argentina were also collected in Great Basin National Park. Future work will be necessary to fully characterize the range of diversity of endolithic lichens in the Great Basin.

A recently described limestone specialist, Tintick's cobblestone lichen (*Acarospora tintickiana*), was found occurring commonly in South Fork of Big Wash. Dozens of other uncommon or unexpected rock-dwelling lichens are now known to occur in the Park. This pattern of diverse, unexpected lichen communities is repeated for soil-dwelling lichens, although to a lesser degree.

Photo by Steve Leavitt

***Xanthomendoza montana* is one of the most common epiphytic lichens in the Intermountain West.**

Photo by Jason Hollinger

***Rusavskia eleganta* (the elegant sunburst lichen) is found from alpine to low elevation habitats.**

There is a somewhat surprising lack of epiphytic (growing on another plant but not parasitic) lichens within the Park as a whole. While a number of these were found on trees in relatively moist riparian zones, for the most part species of *Xanthomendoza* or *Melanohalea* are the predominant epiphytes. Fruticose (shrubby) lichens, such as beard lichens (*Usnea* spp.) and wolf lichen (*Letharia* spp.) are only rarely encountered. Horse hair lichens (*Bryoria* spp.) occur in nearby mountain ranges but have yet to be documented in the Park. However, the arid climate of this Park is probably a major factor in suppressing epiphyte development.

A number of cyanolichens – those whose photosynthetic partners are cyanobacteria rather than green algae – were documented, e.g. *Enchylium tenax* and *Peltigera* species. Because of their frequency and ability to fix nitrogen, these lichens are potentially significant contributors to the nitrogen economy of the plant communities in which they occur in the Park. Similarly, aquatic or semi-aquatic lichens, such as *Dermatocarpon rivulorum*, *Staurothele fissa*, and *Verrucaria hydrela*, are an overlooked but important component in their respective communities.

Despite the rich, diverse lichen communities documented for Great Basin National Park, a significant proportion of lichen diversity is surely yet to be discovered. The current lichen checklist for Great Basin National Park provides an important baseline for future studies and will be critical for ongoing and long-term assessments of the ecological health in the Great Basin region of western North America.

# SNPLMA-Funded Strawberry Creek Restoration Project Complete

by Margaret Horner, Biologist

The Southern Nevada Public Lands Management Act (SNPLMA)-funded Strawberry Creek Fuels Reduction and Sagebrush Steppe/ Aspen Restoration project has come to a close. Initiated in 2015, this fuels reduction and habitat restoration project included 206 acres of Strawberry Creek.

Project objectives were to restore sagebrush steppe habitat, improve aspen condition, reduce fuel loading, and increase the quality and quantity of habitat for shrub-dependent wildlife species. In August 2016, the lightning-ignited Strawberry Fire burned over the entire project area and refocused our restoration strategy. Since fuels reduction and conifer removal objectives were met by the fire, post-fire restoration focused on revegetation treatments, removing hazard trees, stabilizing slopes and streambanks, and surveying and treating invasive plants.

The project area was included in two aerial seedings. A total of 307 acres were seeded with a native seed mix. Native shrub, grass and forb species were used in the mix: mountain big sagebrush (*Artemesia tridentata*), basin wildrye (*Leymus cinereus*), bluebunch wheatgrass (*Pseudoroegneria spicata*), Indian ricegrass (*Achnetherum hymenoides*), redroot buckwheat (*Eriogomum racemosum*), Palmer's penstemon (*Penstemon palmeri*), and arrowleaf balsamroot (*Balsamorhiza sagittata*).

Pre- and post-fire vegetation surveys documented the recovery of native vegetation and establishment of seeded species. All but one of the seeded species were recorded on vegetation plots. As expected, canopy cover decreased the year after the fire, but had recovered and shifted to herbaceous species (grasses and forbs) by 2018. Densities of single-leaf pinyon pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma)* were greatly reduced by the fire. Two years after the fire, plant diversity was greater; and average herbaceous cover of vegetation plots had increased by 36%.

Nuisance and hazard trees were removed on 13 acres. Saw crews completed contour felling of burned trees to help stabilize slopes and protect streambanks. One thousand Ponderosa pine (*Pinus ponderosa)* seedlings were planted on eight acres, and invasive plant surveys were completed on 202 acres. New infestations of houndstongue (*Cynoglossum officinale*), a Nevada noxious weed, and African mustard (*Malcomia africana*) were discovered and treated post-fire. Restoration treatments were conducted with a combination of NPS staff, Exotic Plant Management Teams, and Nevada Conservation Corps crews. Thanks to everyone who helped make this project a success!

NPS Photo by Julie Long

**NPS staff spraying weeds.**

***Note: Strawberry Creek is now open for day-use visitation. Check out the amazing recovery of the area for yourself!***


NPS Photos

**Four photos from site monitoring: Top left: 2015, before the fire; Top right: 2016, after the fire; Bottom left: 2017 with some recovery; Bottom right: 2018 with many more native grasses and forbs. Two years after the fire, average herbaceous cover had increased by 36%.**

# 2019 Snow Survey Results

by Gretchen Baker, Ecologist

After a few dry years, we were excited to see the mountains looking very white this winter. Just how much snow was up there? Park staff and volunteers skied up Baker Creek to measure the snow at three snow courses, at elevations of 8,200, 9,200, and 9,550 feet. At each snow course, a long, aluminum tube was used to make five measurements. The snow tube was driven into the snow until it reached the ground to measure the snow depth. Then the tube was extracted with the snow in it and weighed to obtain the snow water equivalent, or how much water would there be if the snow was converted to water.

At the end of February, the snow water content for all three sites was about 140% of median (1981-2010). The snow depth was about 120% of median. At the highest site, the snow was about 59 inches deep.

At the end of March, the snow water equivalent for the three sites was about 170% of the median (1981-2010; Table 1). That is the highest snow total at the Baker Creek snow courses since 2005, when we had 300% snow pack. It's also the fifth highest since measurements started in 1942. You can see historical data for the Baker Creek Snow Courses on the Natural Resources Conservation Service website.

NPS Photo by G. Baker

**Snow survey participants ski to the next snow course along Baker Creek. Snow water equivalent was high this winter, which will lead to swollen creeks, many pools in Lehman Caves, and lots of wildflowers.**

You can also see real-time snow and climate data from the Wheeler Peak Snotel Station (click "Last 7 Days" next to "Standard Sensors"). In addition, you can look at photos of the site, with one taken each day.

That extra snow pack means Lehman Caves will be wetter than usual. We've already seen spouters (water coming out the sides of soda straws), soda straws with bubbles on the end (how we think turnip stalactites might grow), and pools filling. The Wishing Well, on the way into the Sunken Garden, has water in it again after being dry last year. And the water level in the Sunken Garden is the highest it's been in decades. If you haven't been in the cave for a while, it's a great time to take a look.

We can also expect streams to be higher, so be extra careful around them. Peak flow is generally mid-May to the end of June, with enough water in the creeks to wash someone downstream. You can even hear boulders rolling in the current when the water gets higher. Watch out for roads and trails flooding.

The extra snowpack also means it should be a great wildflower year.

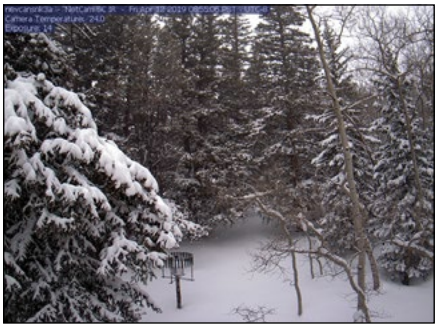

**Photo of Wheeler Peak Snotel Site, taken April 12, 2019.**

**Table 1. March 28, 2019 Snow Survey Results**

| Site | Elevation | Snow Depth (% of median) | Snow Water Equivalent (% of median) |
|---|---|---|---|
| **Baker Creek #1** | 8,200 ft. | 32.8 inches (182%) | 10.8 inches (186%) |
| **Baker Creek #2** | 9,200 ft. | 65.1 inches (148%) | 22.2 inches (164%) |
| **Baker Creek #3** | 9,550 ft. | 79.5 inches (147%) | 27 inches (161%) |

# Don't Move Firewood

by Julie Long, Wildlife/Plants Biological Science Technician

Why is moving firewood something we should think about? The answer is pretty straightforward: Movement of logs and firewood can transport tree-killing insects and diseases. Insects and disease agents are small, unable to move long distances on their own, and oftentimes go unnoticed because of where they live - underneath bark and within trunks or branches. Transporting firewood to a new area can aid in the spread of these harmful insects and pathogens. Those that are non-native are especially vicious, as native species often do not have natural defenses against them.

To monitor forest health conditions at Great Basin National Park, the park partners with the State of Nevada and U.S. Forest Service (USFS). Over the past ten years, the USFS has conducted aerial detection surveys to monitor insect and disease impacts on the park's forests. Park staff and USFS have also treated high value limber pine (*Pinus flexilis*) and ponderosa pine (*Pinus ponderosa*) with SPLAT® verbenone, an anti-aggregation pheromone. This naturally occurring pheromone tricks mountain pine beetles (*Dendroctonus ponderosae*) into thinking that a tree has already been colonized and therefore protects the tree from mountain pine beetle infestation.

In 2017, USFS forest health specialists observed the following insects and diseases on Engelmann spruce trees near Wheeler Peak Campground: spruce broom rust (*Chrysomyxa arctostaphyli*),

NPS Photo by Julie Long

**Singleleaf pinyon pine is susceptible to many diseases and pests.**

Cooley spruce gall agelgid (*Adelges cooleyi*), spruce engraver (*Ips* spp.) and spruce beetle (*Dendroctonus rufipennis*). If additional pests or diseases are brought in, they can weaken the trees even more and cause more tree mortality.

**Five Ways You Can Help:**

- Buy or gather firewood where you will burn it.
- Leave your firewood at home. Fungi spores are microscopic!
- Spread the word to raise awareness in your community.
- Check your state's firewood transportation guidelines. https://www.dontmovefirewood.org/map/
- Purchase certified, heat-treated firewood.

To find additional information on pests in firewood please visit www.dontmovefirewood.org.

# GLORIA 2019 Update

by Meagan Oldfather, Jan Nachlinger, Brian Smithers, GLORIA-Great Basin Organizers

GLORIA (Global Observation Research Initiative in Alpine Environments) is a collaborative network with a shared methodology for surveying alpine summits across the globe (https://www.gloria.ac.at). The main objective of GLORIA is to assess global distributional shifts of alpine species in response to climate changes. It is a tremendous effort with over 100 alpine areas in the global network.

The local non-profit GLORIA Great Basin (https://www.gloriagreatbasin.org) leads the effort at eight of these areas in eastern California and Nevada.

In collaboration with Great Basin National Park, GLORIA Great Basin coordinates the field survey work and data management in the southern Snake Range. This area is the heart of the Great Basin and offers a unique area in comparison with several other western-edge Great Basin sites located in the White Mountains, Sweetwater Mountains, and Dunderberg Peak area, the latter situated at the transition of central Sierra Nevada-western Great Basin biogeography.

Here at Great Basin National Park, there are four GLORIA study peaks (Buck Mountain, Bald Mountain, Pyramid Peak, and Wheeler Peak) which were established in 2008, and have been resurveyed in 2013 and 2018. From Buck Mountain at

Photo by Jan Nachlinger

**Top photo: Wheeler sandwort (*Eremogone congesta var. wheelerensis*) only occurs on a few peaks in eastern Nevada.**

**Bottom photo: Holmgren wild buckwheat (*Eriogonum holmgrenii*) is one of three plants that is endemic to high elevations in Great Basin National Park.**

3,347 m elevation, where tree line transitions to an alpine environment, to the shoulder of Wheeler Peak at 3,981 m elevation, the four peaks have similar local climates and geologic substrates.

The alpine flora of these peaks is quite noteworthy for unique species, common Rocky Mountain species not found at the western Great Basin sites, and for ubiquitous high elevation plants common across North American sites.

First, the overall species richness of the flora is somewhat less than, but comparable, to the sites in the western Great Basin, and many species are similar. There are at least fourteen plant species that do not occur in any of the other seven areas targeted by GLORIA Great Basin. Among them are eight plant taxa with affinities to the Rocky Mountains rather than the Sierra Nevada (these two peripheral ranges are major source areas contributing to the desert mountains regional flora between them). Buck Mountain harbors two Rocky Mountain conifers, *Juniperus communis* var. *depressa* (dwarf juniper), and the tree line species *Picea engelmannii* (Engelmann spruce), as well as the herb *Mertensia franciscana* (Franciscan bluebells), which apparently only occurs in Nevada in the Snake Range. Additionally, five showy Rocky Mountains alpine plants are found on one or all four peaks: *Geum rossii* var. *turbinatum* (alpine avens), *Polemonium viscosum* (sticky sky pilot), *Primula parryi* (Parry primrose), *Silene acaulis* (moss pink), and the uncommon *Erigeron grandiflorus* (largeflower fleabane), which currently is only known from Nevada in the Snake Range.

Three unusual perennial plants are noteworthy here because they have restricted distributions to the eastern Great Basin. *Eremogone congesta var. wheelerensis* (Wheeler sandwort) and *Penstemon leiophyllus var. francisci-pennellii* (smoothleaf beardtongue) only occur in a few of eastern Nevada's high ranges, while *Potentilla holmgrenii* (Holmgren cinquefoil) only occurs in two eastern Nevada ranges and a neighboring range in western Utah.

*Continued on Page 7*

# GLORIA 2019 Update (continued)

However, the coolest of Great Basin National Park's GLORIA plants are the three perennial taxa that only occur at high elevations in the Snake Range and nowhere else—they are Snake Range (and Great Basin National Park) high elevation endemics. These plants are vulnerable to climate change because there is very little alpine real estate where they currently exist and we do not know how successfully they might be able to hold on with other species potentially moving up mountain slopes in response to warming or drying conditions. They are *Draba serpentina* (Snake Range whitlowcress), *Eriogonum holmgrenii* (Holmgren wild buckwheat), and *Potentilla hookeriana* var. *charletii* (Charlet cinquefoil).

Photo by Brian Smithers

**Conducting a GLORIA resurvey takes a team. Plots are laid out and then botanists survey the area to find what plants live there.**

GLORIA Great Basin is grateful to the many people who first established these surveys. Ann Dennis was the GLORIA coordinator for the first team to select sites and establish plots along with Gretchen Baker and Meg Horner from the National Park Service. Glenn Clifton, independent botanist, has been involved with every survey and his flora of the South Snake Range has been very helpful (Clifton 2012). Great Basin National Park has contributed both personnel time, field logistics, and equipment to this effort which is greatly appreciated by GLORIA Great Basin.

One of the main objectives of GLORIA Great Basin is to not only continue these resurveys into the future, but also analyze the resurvey data to understand how alpine plant communities vary spatially and temporally.

Alpine plants have been recognized as early indicators of plant community responses to a changing climate, with both amplified warming and community change at higher elevation relative to lower elevation (Bertrand *et al.* 2011; Pepin *et al.* 2015). Many recent studies, including those using GLORIA data from other sites, have found that species richness (total number of species) has increased with warming (Steinbauer *et al.* 2018).

However, there is some evidence that this pattern may be muted or even reversed in water-limited alpine systems (Pauli *et al.* 2012), such as in the drier Great Basin National Park peaks. This increase in richness with warming has been hypothesized to be driven by more warm-adapted low elevation or sub-alpine species moving upslope, as well as a lag in the competitive exclusion of obligate alpine species (Lamprecht *et al.* 2018). Although we have yet to examine the temporal dynamics of the Great Basin National Park peaks, we hope to be able to report back soon with more analyses, so stay tuned! Also, if you are interested in becoming involved with the GLORIA plant surveys in any capacity please contact us at: gloriagreatbasin@gmail.com.


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Want to learn how climate change might be affecting the ancient bristlecone pines in the Great Basin? Check out this Science Friday seven-minute-long video.

Featured is Brian Smithers, one of the GLORIA organizers.

# Lehman Caves Geology Part III

by Louise D. Hose, Cave Geologist

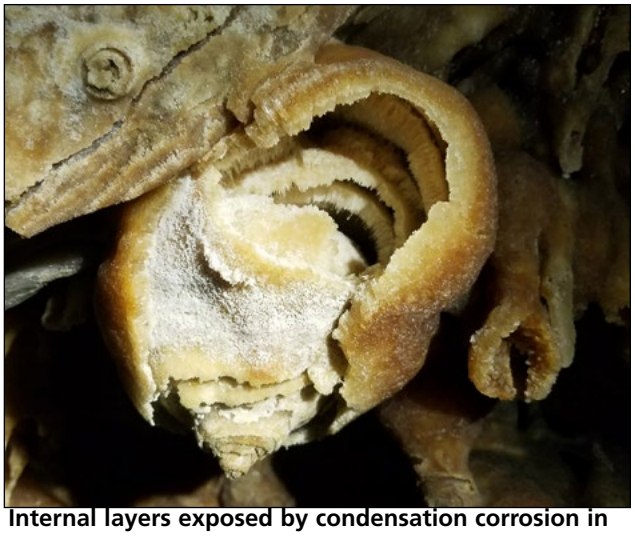
The following article is excerpted from a paper I prepared for the Great Basin National Park staff on the *Geologic Story of Lehman Caves*. In the last two issues, I wrote about Stage 1, the Sulfide-rich, Hypogenic Speleogenesis time and Stage 2, Secondary Deposits and Finding Stability in a New Environment. In this issue, I talk about Stages 3, Calcite Speleothems and the Pleistocene, and 4, Condensation-Corrosion Speleogenesis.

**Stage 3 – Secondary Deposits – Calcite Speleothems and the Pleistocene**

The most notable features in the cave to the average visitor are the abundant calcite speleothems, which appear to have formed almost entirely in the Pleistocene between 2.2 million and 7700 years ago. A couple dozen stalagmites have been dated and the majority grew between 125,000 and 250,000 years ago. The oldest date, however, is 2.2 million years old (Lachniet and Crotty 2017).

**Stage 4 – Condensation-Corrosion Speleogenesis**

Following the Pleistocene, the surface conditions dried and, probably after the natural entrance connected the cave to the surface allowing greater exchange of surface air with the cave air, condensation corrosion due to carbonic acid became the dominant cave process. It is likely still actively and slowly altering the cave's appearance. Water vapor in the cave has picked up $CO_2$ from the air then condensed on the walls, ceilings, and calcite speleothems as a film of carbonic acid. This moisture etches the marble bedrock or calcite speleothems. Condensation corrosion can preferentially etch some portions of a speleothem and reveal the internal crystal structure.



NPS Photo by G. Baker

**Internal layers exposed by condensation corrosion in a Lehman "turnip" stalactite.**

Dissolution along individual grain boundary in the marble bedrock produces disintegrated sandy or fluffy residue of mostly calcite on the walls and ceilings of the cave. This "punk" rock is soft, flaky, typically beige/tan or gray, and lines much of the walls and ceiling along the Lehman trails where dripstone and flowstone does not cover the bedrock.

Some early explorers recognized the soft nature of the rock and left inscriptions scratched into it, forsaking the need for carving tools or soot. The powdery material also sloughs off the walls and ceilings and accumulates onto the cave floor, similar to the process of the gypsum paste falling onto the floor when the cave first formed.

Condensate water also enters pores and fractures in the bedrock and speleothems or forms thin films of water and carries its dissolved content along the surface. As this water evaporates or temperatures change slightly, various speleothems may form. Much or most of the popcorn and aragonite frostwork in the cave likely formed through mechanisms related to condensation water. This manner of evaporation-and-condensation is most common in caves where circulation of air between entrances is limited and where there is little running water. It is typical of hypogenic caves in dry climates, both active and inactive. Lehman Caves certainly matches these descriptions.

NPS Photo by G. Baker

**Eagle's Wing in the Lodge Room provides a good example of a calcite speleothem corroded by acidic condensation.**

# Night Sky Assessment Shows More Light from Ely

by Ashley Pipkin, Natural Sounds and Night Skies Coordinator, NPS Pacific West Region

On September 10, 2018 the Natural Sounds and Night Skies coordinator for the Pacific West Region, Ashley Pipkin, took a night sky assessment at Great Basin NP. She was assisted by field staff and went to the top of Mt Washington where she used a CCD camera to collect an all-sky image. This image is actually composed of 46 pictures of the sky stitched together to create one image. This single image can be processed and assessed for night sky quality and the amount of anthropogenic light that is added to the nocturnal environment.

The last image collected at Great Basin was in 2005 and the park wanted to know how the sky had changed.

Overall, Great Basin still has an amazing night sky with very few visible light domes, or light groups from distant cities. There were not significant increases in brightness from any cities although an increase in brightness from the Ely light dome was visible on the images.

***Check out the Astronomy Ranger Minute to learn more about why we care about the night sky.***

NPS Photo by Ashley Pipkin

**Sunset on Mt. Washington, where the night sky assessment was performed.**

# What Happens to Small Mammals with More Trees?

by Bryan Hamilton, Acting Chief of Natural Resource Management

Meg Horner (NPS Biologist) and I recently published a peer-reviewed paper in Rangeland Ecology and Management

The highlights are:

- Conifer encroachment into sagebrush habitat has dramatically reduced small mammal abundance (-270%) and biomass (-230%).
- Sagebrush restoration increased native shrub cover (13%) and invasive, non-native cheatgrass density (380%) but did not increase native herbaceous plant densities.
- Sagebrush restoration reduced the density of the woodland specialist piñon mouse (-80%).
- Overall sagebrush restoration treatments had few effects on small mammal diversity.
- Sagebrush restoration maintained small mammal densities in the face of conifer encroachment.

In addition to the effects of restoration and encroachment on small mammals, the paper does a good job of describing the issue of conifer encroachment and the scale of sagebrush restoration. The data is all from Lehman Flat along the Wheeler Peak Scenic Drive.

**National Park Service**
**U.S. Department of the Interior**

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

A summer and winter issue are produced each year and 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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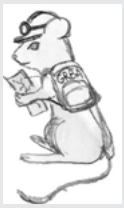


## What's a midden?

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

# Citizen Science in Action

Would you like to learn more about the nature around you? Or record what you see in Great Basin? Or perhaps help your teenager connect technology with nature?

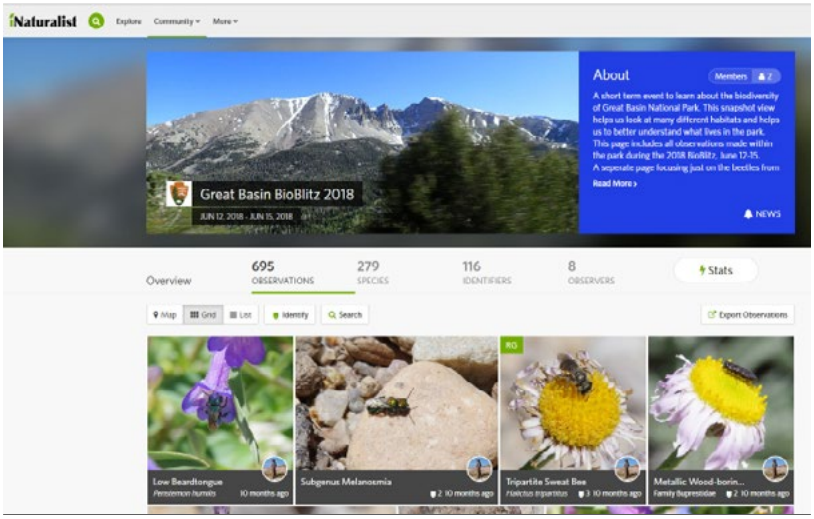
One way to do that is with iNaturalist, both a free app and a website that allow you to record the nature you're seeing around you.

We have an iNaturalist page for the park: https://www.inaturalist.org/projects/great-basin-national-park.

Also, for the 2018 Beetle BioBlitz for Great Basin National Park, experts from the Los Angeles County Natural History Museum started a special iNaturalist page just for the BioBlitz. In only four days, they found 278 species! See the results here.

What if you don't know what flower, insect, or mushroom you're seeing? iNaturalist has started a new app called Seek, where you can take a photo of it and get a name for that organism!

The park hopes to use iNaturalist more to learn about what is blooming and what animals are being seen. Add your observations today!




**The Great Basin National Park 2018 BioBlitz iNaturalist page shows 278 species for just four days!**

## Upcoming Events:

**May 15-June 14 Cave Management Plans for Review** Want to check out what's in store for the future of the 40 known caves in the park? Public review is welcome on the Lehman Caves and Wild Caves and Karst Management Plans. Visit https://parkplanning.nps.gov/

**August 20-22 Bat BioBlitz** Join bat experts and learn about these amazing nocturnal mammals. For more information, email GRBA_BioBlitz@nps.gov.

**September 26-28 Great Basin National Park Astronomy Festival** Enjoy some of the darkest night skies in the country with talks, activities, and multiple telescopes. Find more info at: https://www.nps.gov/grba/planyourvisit/astronomy-festival.htm

**September 28 Public Lands Day** The last Saturday of September is Public Lands Day, and this year Great Basin National Park will be hosting it for White Pine County. A service project and various educational booths will be available. Contact 775-234-7331 for more information